GGY 4031
LECTURE NOTES 7c
Glacial

Glacial Environments

- **Ice** accumulates in areas where the addition of snow each year exceeds the losses due to melting, evaporation or wind deflation.
- **Ice is a solid,** but under pressure it will behave in a ductile manner and flow by moving away from the point of higher pressure. Pressure is provided by the weight of ice above any particular point and the ice will flow slowly as an extremely ***viscous fluid***

Glacial Environments

•The **climate** is clearly a controlling factor, as these conditions can be maintained only in areas where there is either a large amount of winter snow that is not matched by summer thaw, or in places that are cold most of the time, irrespective of the amount of precipitation.

•There are two main types of glacial terrains: **temperate (or mountain) glaciers and polar ice caps.**

Glacial Environments

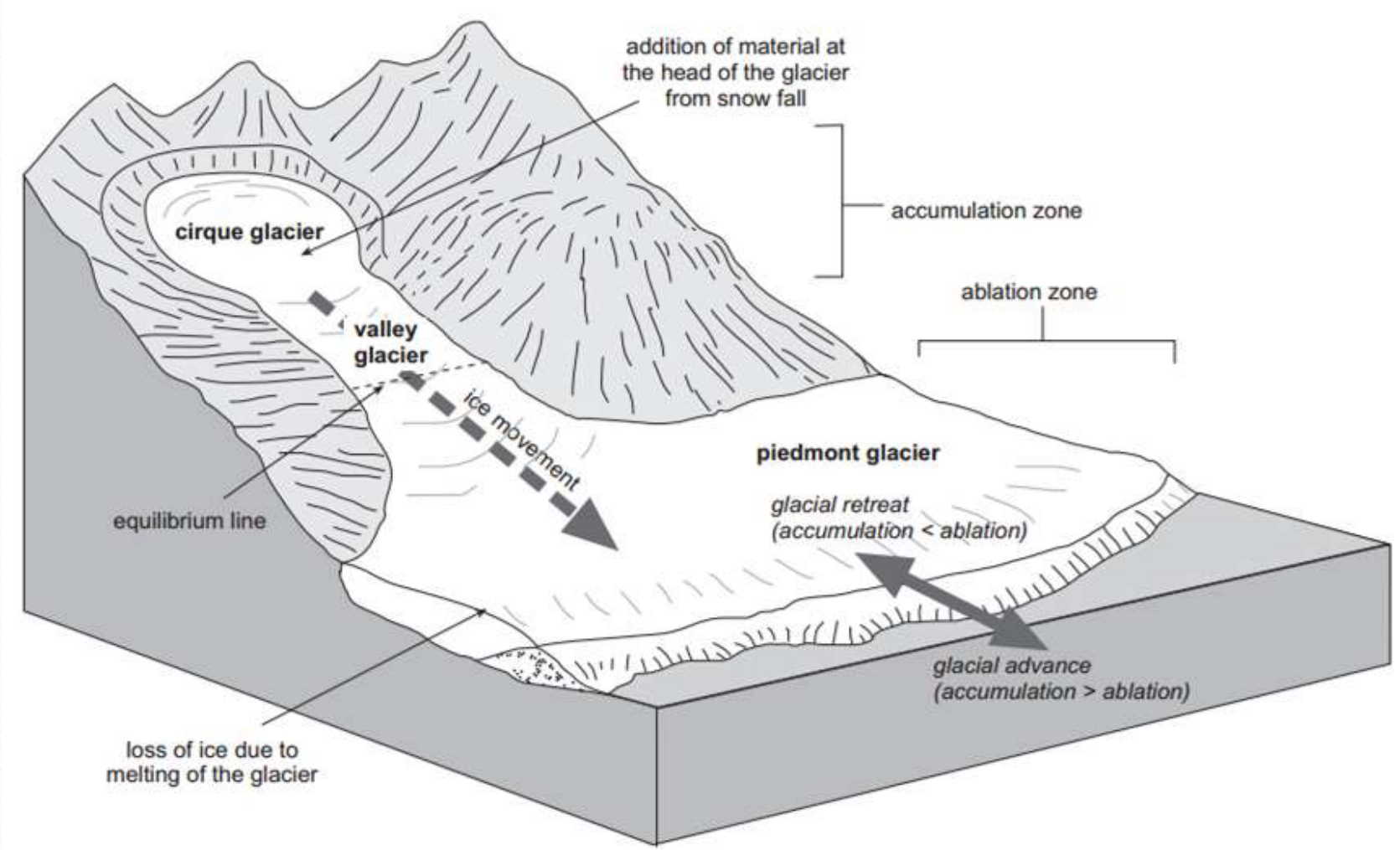
- **Temperate or mountain glaciers** form in areas of relatively high altitude where precipitation in the winter is mainly in the form of snow.
- Temperate glaciers are typical of mountainous regions in lower latitudes. The ice is above the pressure melting point throughout the glacier and it is able to slide easily over the underlying bedrock
- **Polar glaciers** occur at the north and south poles, which are regions of low precipitation

Glacial Environments

•Once snow has formed, the weight of snow accumulates in the upper part of the glacier (**accumulation zone** of the glacier) causes it to move *downslope*, where it reaches lower altitudes and higher temperatures.

•The lower part of the glacier is the **ablation zone** where the glacier melts during the summer

Glacial Environments



Glacial Environments

Transport by continental glaciers

•Debris is incorporated into a moving ice mass by two main mechanisms:

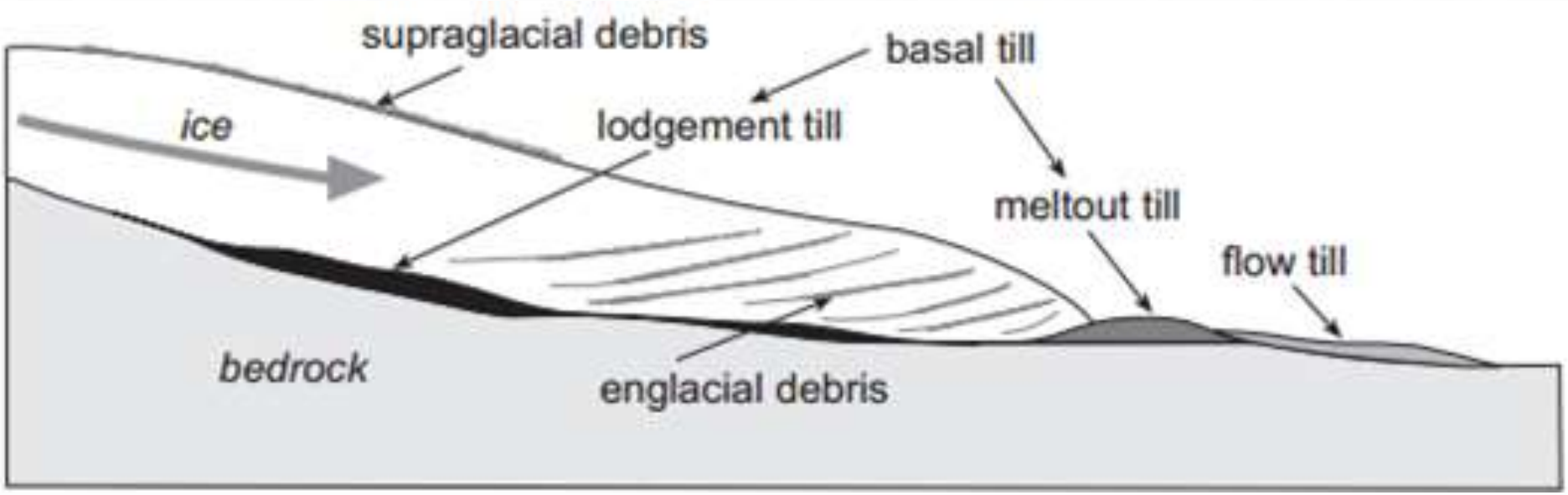
➢***Supraglacial debris*:** accumulates on the surface of a glacier as a result of detritus falling down the sides of the glacial valley. ***Supraglacial debris*** is dominantly coarser-grained material with a low proportion of fine-grained sediment.

➢***Basal debris:*** form by processes of abrasion and plucking from bedrock by moving ice. Basal debris tends to be of very fine to coarse material

Glacial Environments

- **Melt water** between the *glacier* and the *bedrock* forms a lubrication zone allowing the ice to move more freely with less erosion
- During movement of a glacier, the ice mass undergoes deformation, internal folding and thrust faulting that can mix some of the **basal** and **supraglacial** debris into the main body of the glacier.
- **Till (diamicton)**: deposits of ice if it is unconsolidated or **tillite (diamictite)** if it is lithified.

Glacial Environments



Glacial Environments

- **Characteristics of glacial transported material**
- Poorly sorted-transport is generally laminae
- Angular sediment shapes
- Texture is generally immature
- Physical processes (i.e. physical weathering) is dominant than chemical weathering, hence clay minerals are uncommon

Glacial Environments

❑**Characteristics of glacial deposits**

•**Lithologies** – conglomerate, sandstone and mudstone

•**Mineralogy** – variable, compositionally immature

•**Texture** – extremely poorly sorted in till to poorly sorted in fluvio-glacial facies

•**Bed geometry** – bedding absent to indistinct in many continental deposits, glaciomarine deposits may be laminated

•**Sedimentary structures** – usually none in tills, cross-bedding in fluvio-glacial facies

•**Palaeocurrents** – orientation of clasts can indicate ice flow direction

.

Glacial Environments

- **Fossils** – normally absent in continental deposits, may be present in glaciomarine facies
- **Colour** – variable, but deposits are not usually oxidised
- **Facies associations** – may be associated with fluvial facies or with shallow-marine deposits

Glacial Environments

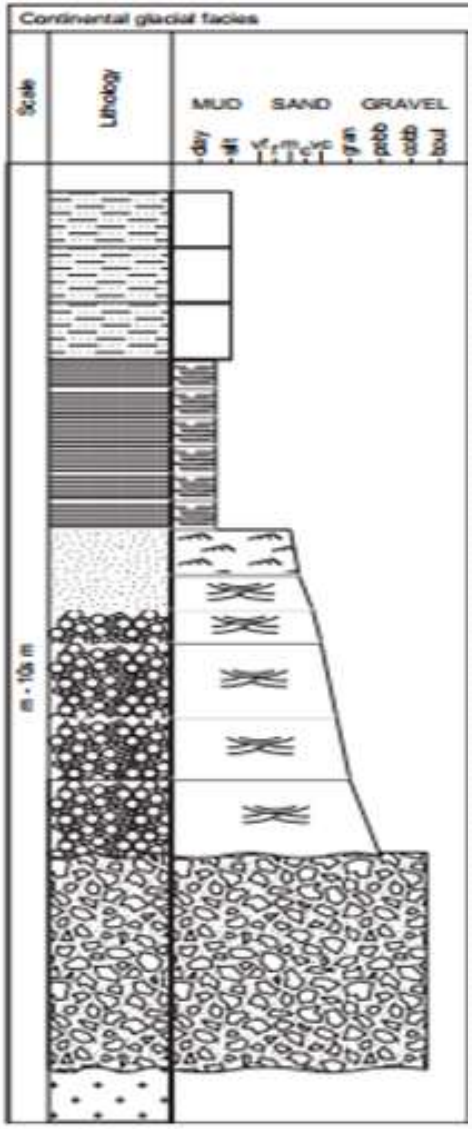


Fig. 7.8 Graphic sedimentary log il
deposits of continental glaciers.

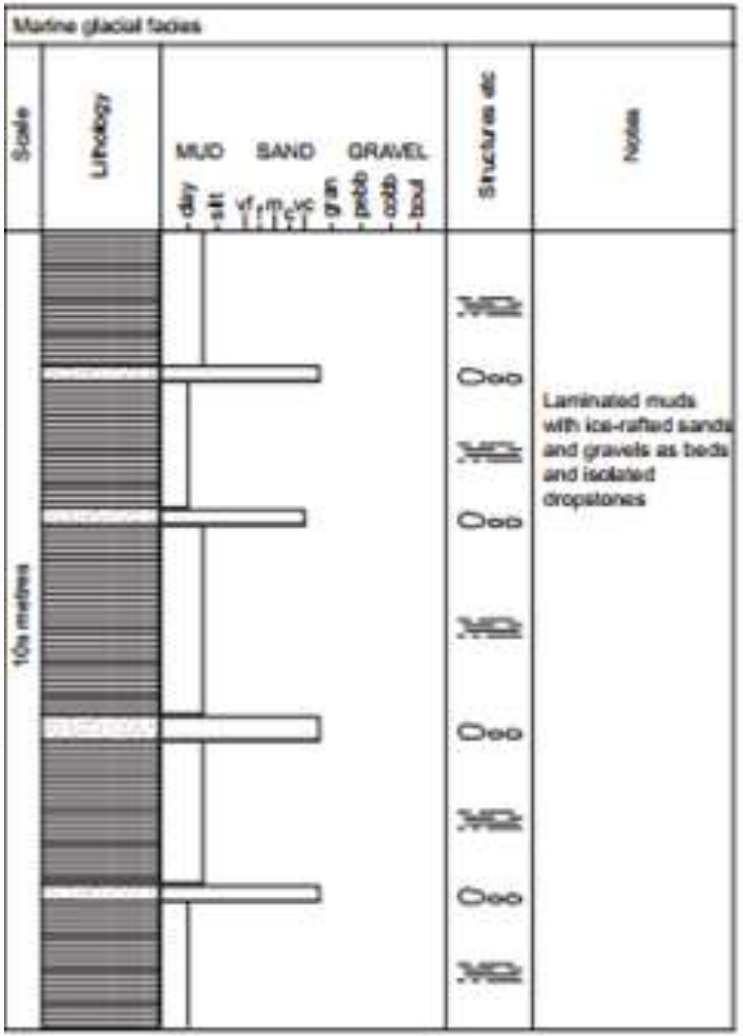


Fig. 7.14 Glaciomarine deposits are typically laminated mudrocks with sparse coarser debris derived from icebergs.