

University of Anbar

College of Science – Applied Geology Department

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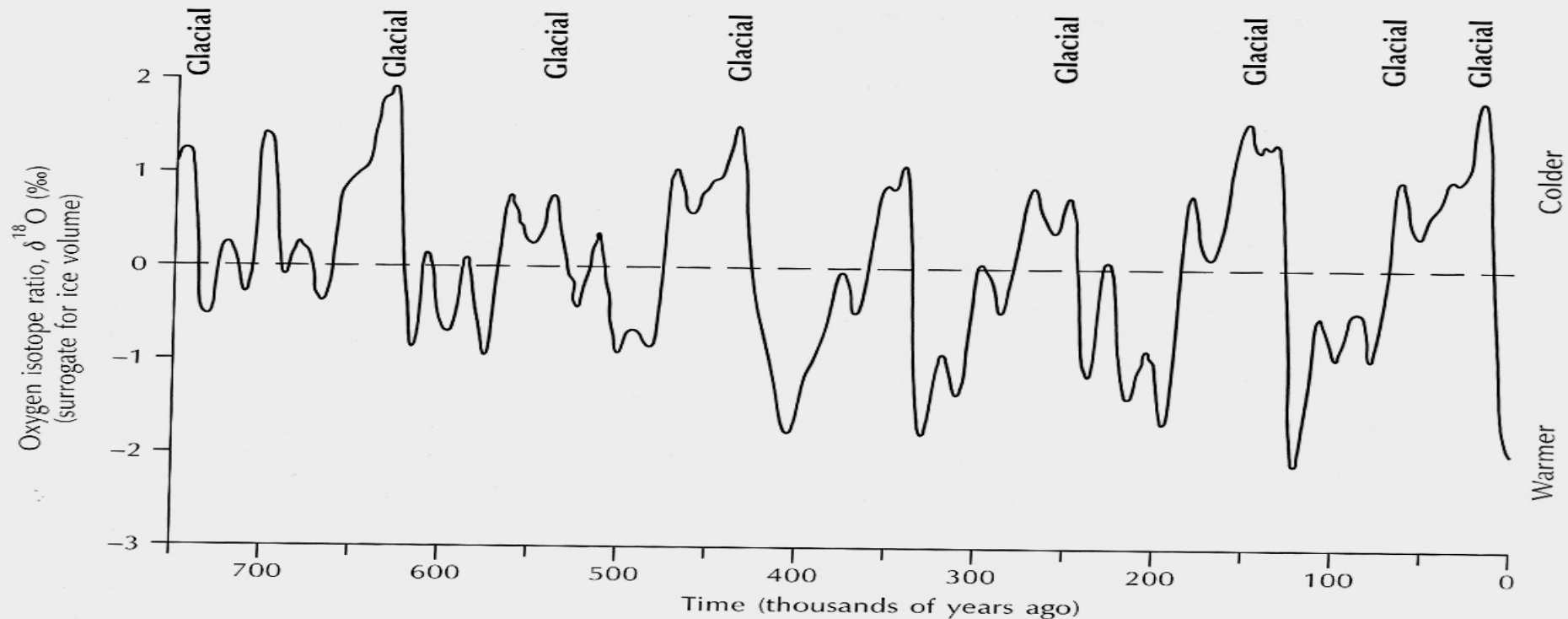
Assis. Professor

4th Stage

Quaternary

Lecture 3: Glacial Systems – part 1

The model of four Quaternary glaciations designed for more than half a century ago. Since the 1960s, however, much new evidence has accumulated that indicates: (1) the Quaternary began at least 1½ million years ago, perhaps more than 2 million years, (2) many more than four glaciations took place during the Quaternary. The exact number of major glacial cycles is not known, but is at least ten or probably more, each lasting about 100,000 years in duration.



Glacial Systems

An open system of flowing ice : Water input as snow

Transformed into ice

Ice flows under pressure

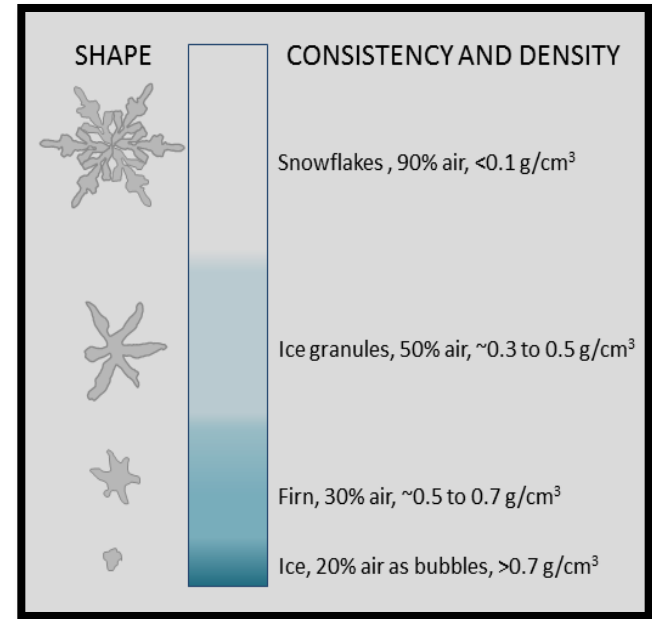
Water leaves by evaporation and melting

Most important glacial system effects

- Modify pre-existing landforms
- Cause crustal subsidence
- Modify drainage systems
- Important component of the hydrologic system & climate

Steps of Glaciations

Any area receiving more snow in cold seasons than melts in warm seasons has a net accumulation over the years . As accumulation takes place , snow at depth is converted to ice when it reaches a critical thickness of about 40 m it begins to flow in response to pressure



Zones of Glacial

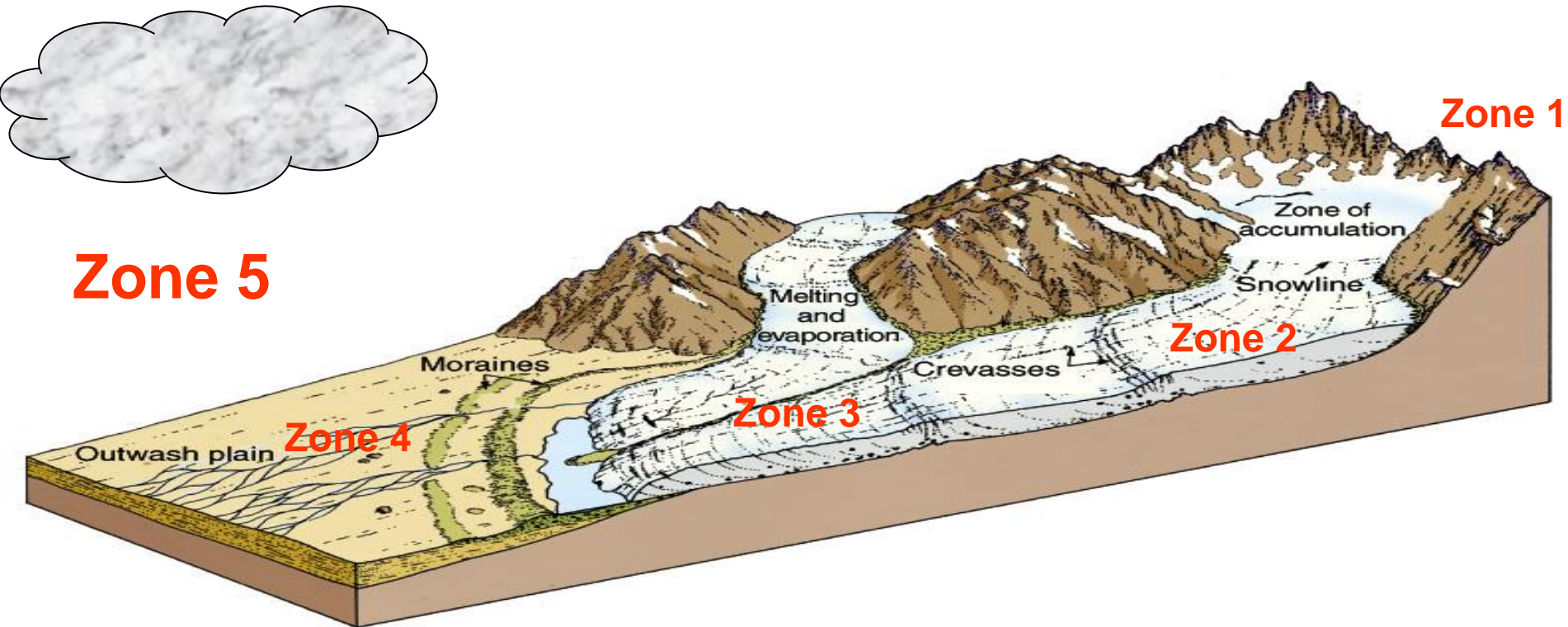
Zone 1 : accumulation of ice and snow , no processes happen

Zone 2 : intermediate zone , effect glacial erosion happen

Zone 3 : preferred zone , external zone , glacial deposition

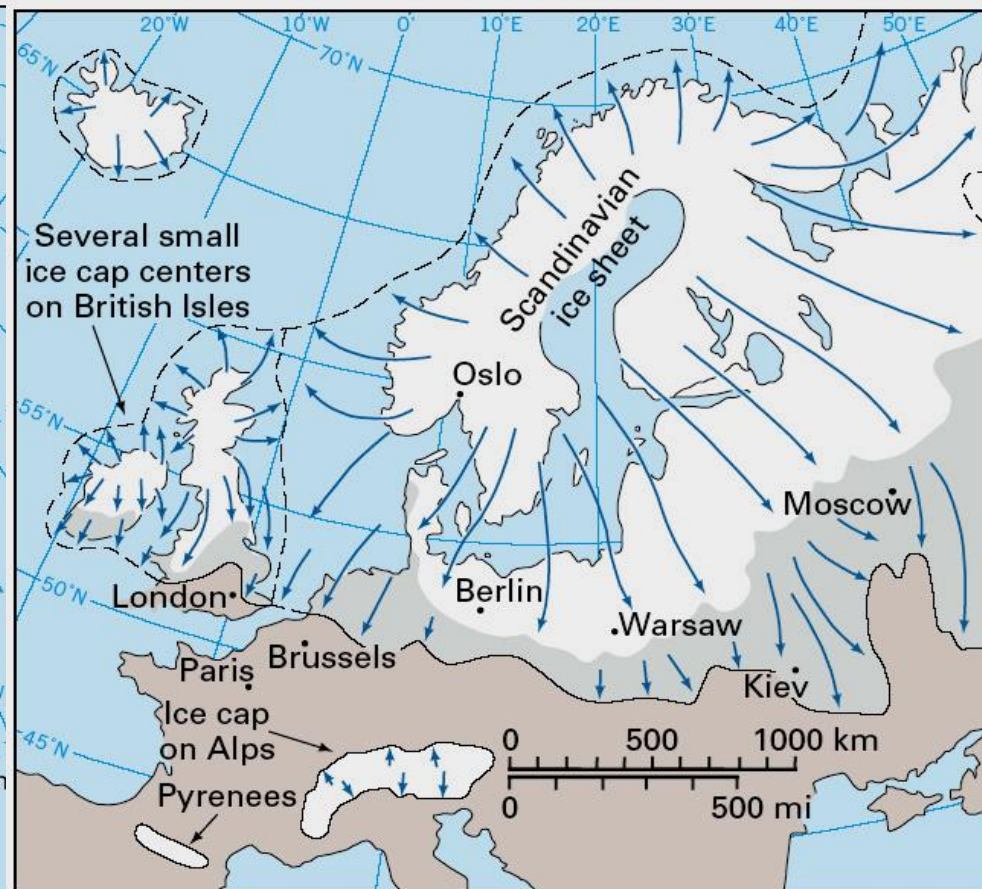
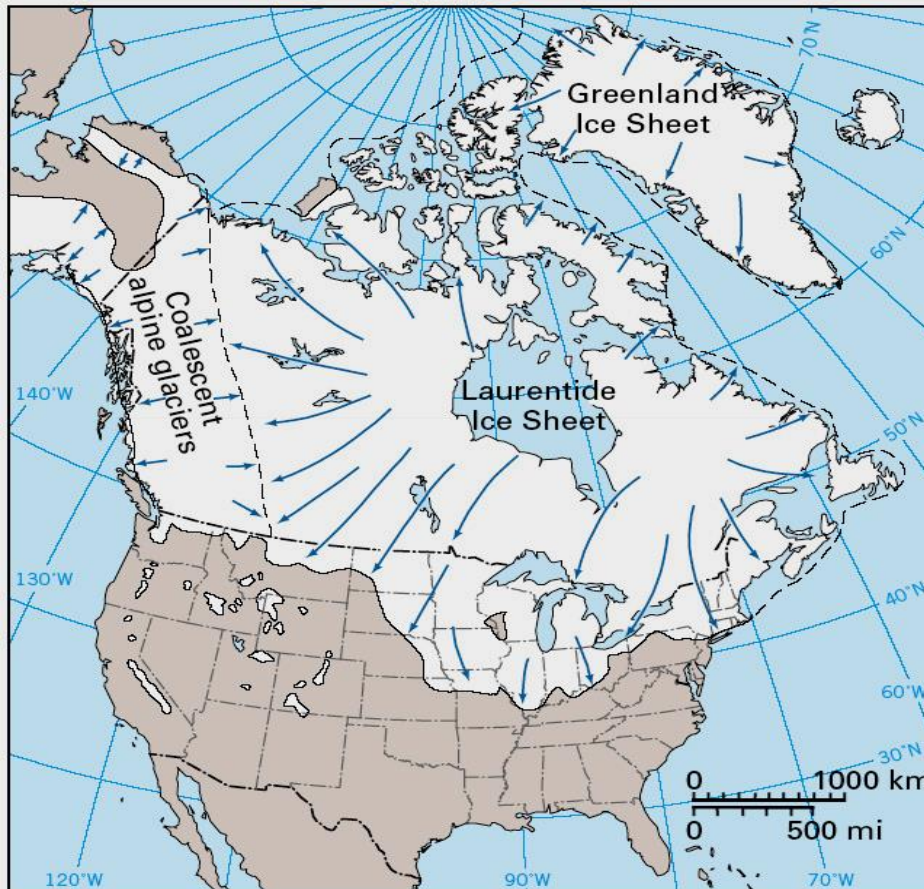
Zone 4 : ice marginal zone , exist near the main glacial , some rivers come from ice melting

Zone 5 : far away of glacial , climate or sea level



Results of the Ice Age

1. Climatic zones in the Northern Hemisphere were shifted southward.
2. Arctic conditions prevailed across Europe and the U.S.
3. Sea level dropped as much as 75 m (225 ft) and the shoreline shifted seaward, exposing the continental shelves as dry land.



4 - Streams cut deep canyons into the continental shelves and on land.



5 - The land was digging by glaciers in Europe and North America.

6 - U-shaped valleys formed in mountainous areas

7 - Rainfall increased at lower latitudes.

8 - Large lakes formed in the Basin and Range Areas .

9 - Winds coming off glaciers blew fine sediment southward forming
loess deposits

10 - Parts of northern and eastern Africa that are currently arid had
abundant water and were populated with agricultural areas

11 - Weight of the ice depressed the continental crust to as much as 200-
300 m downward.

12 - Uplift (isostatic rebound) after ice melted. Coastal features are now
elevated high above sea level.

Types of Glaciers

Glaciers divided into 3 subsystems:

1 – Mountain Glaciers

A- Ice streams flowing from mountain areas down valley

B- Ice caps

- Covers large area of mountains
- or high altitude plains
- Ice shows outward radial flow

C- Cirque

Depression happened because of pressure and heavy weight of ice that was covered it

- A protected bowl shaped depression
- Bounded by steep cliffs, headwall



- Open on the down slope side
- After the melting of ice can form
Cirque lake or tarn

Growing cirque spreads down a valley

Glaciers may fill long mountain valleys

Glacier pluck rock debris forming
moraines



Paternoster Lakes

A chain of lakes in a glacial valley



Tarn



Seracs

- Ice towers on glacial
- Usually better developed at the bottom of the glacial



Nunatak

Peak surrounded by glaciers but not itself glaciated



References

Glacial and Quaternary Geology

http://www.colby.edu/geology/GE354/Index_GE354.html

Internet Remote Sensing Lectures sites