

# Glacial Deposition

# Till

*Definition: accumulations of angular, unsorted, unstratified mixtures of clay, silt, sand, gravel, and boulder sized fragments resulting from direct glacial deposition.*



Deposition of glacial load occurs as a result of:

**Lodgement:** rock material is deposited by the sole of the glacier in a sub-glacial environment. It is often reworked following the initial deposition.

**Ablation:** rock debris is left as a result of loss of water through ablation (melting and/or sublimation).

Where, when and why deposition occurs depends on a range of factors including:

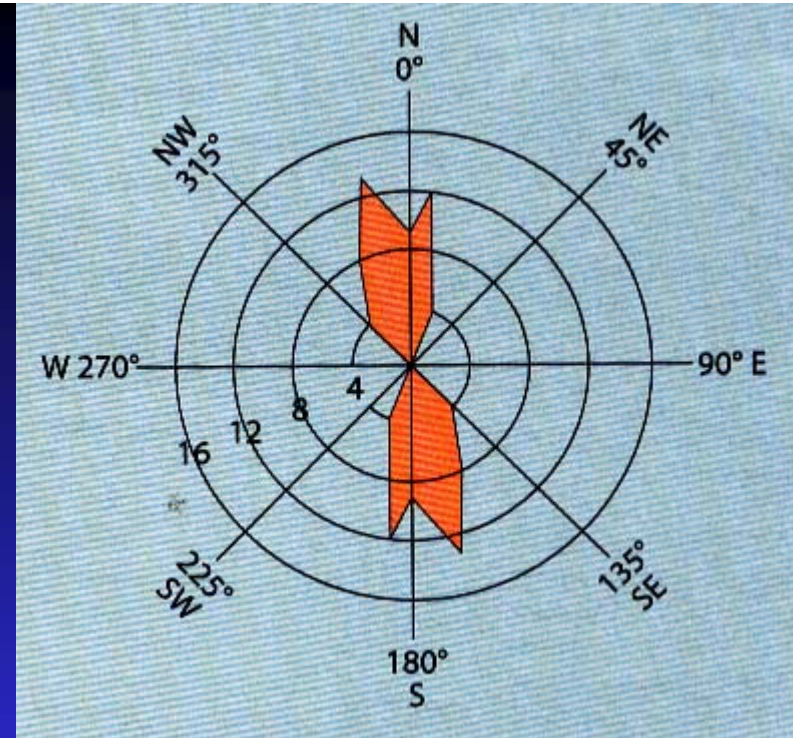
- the temperature of the ice and surrounding air
- ice thickness
- the nature of the bedrock and
- the characteristics of the debris (size, rock type, etc.).

Glacial deposits are generally:

- unsorted,
- angular and
- unstratified.

Glacial tills may display a common orientation of elongated particles, usually in the direction of ice-flow.

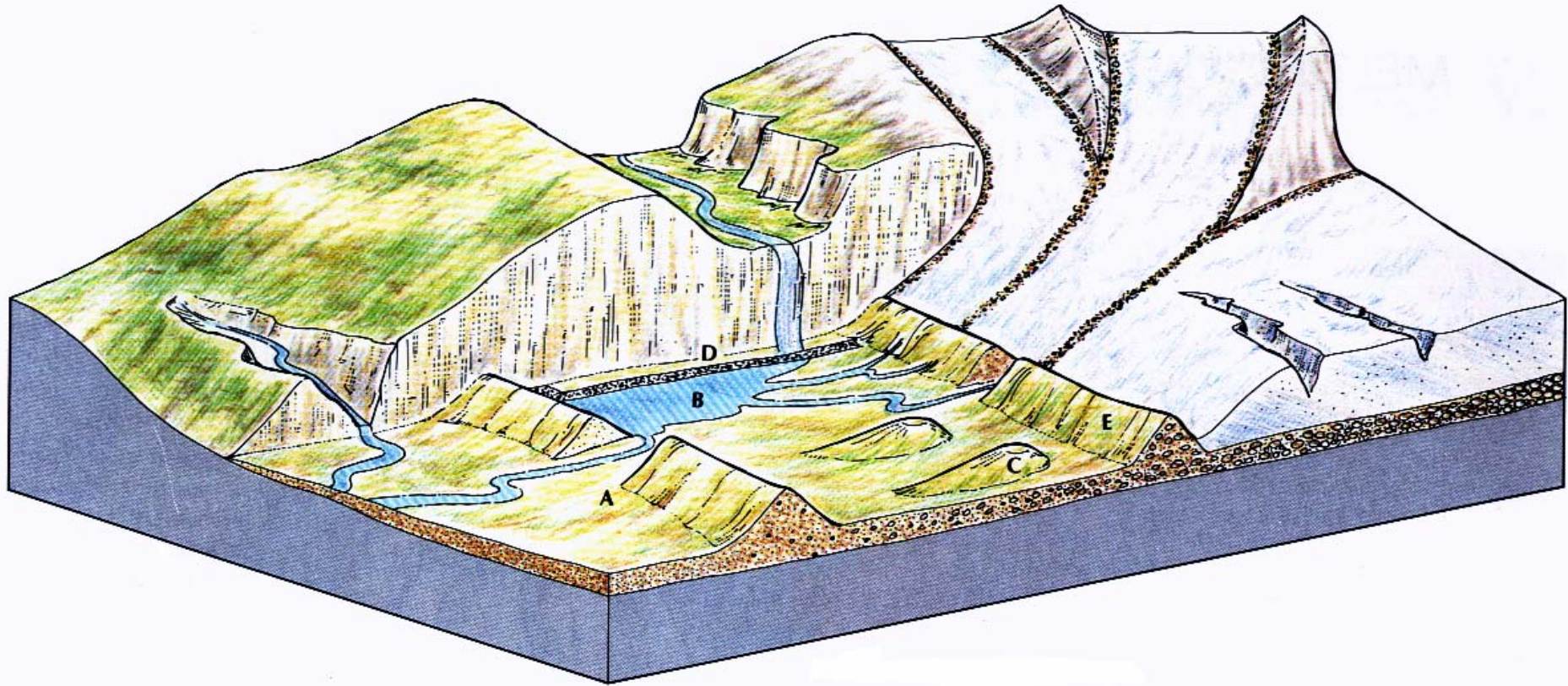
Till-fabric analysis can tell us much about the flow patterns of former glaciers.



The example rose diagram (above), taken from moraine deposits on the Isle of Arran, shows a north-north-west to south-south-east direction of flow.

How was this diagram compiled?

# Some landforms resulting from glacial deposition



A) Ground moraine deposits

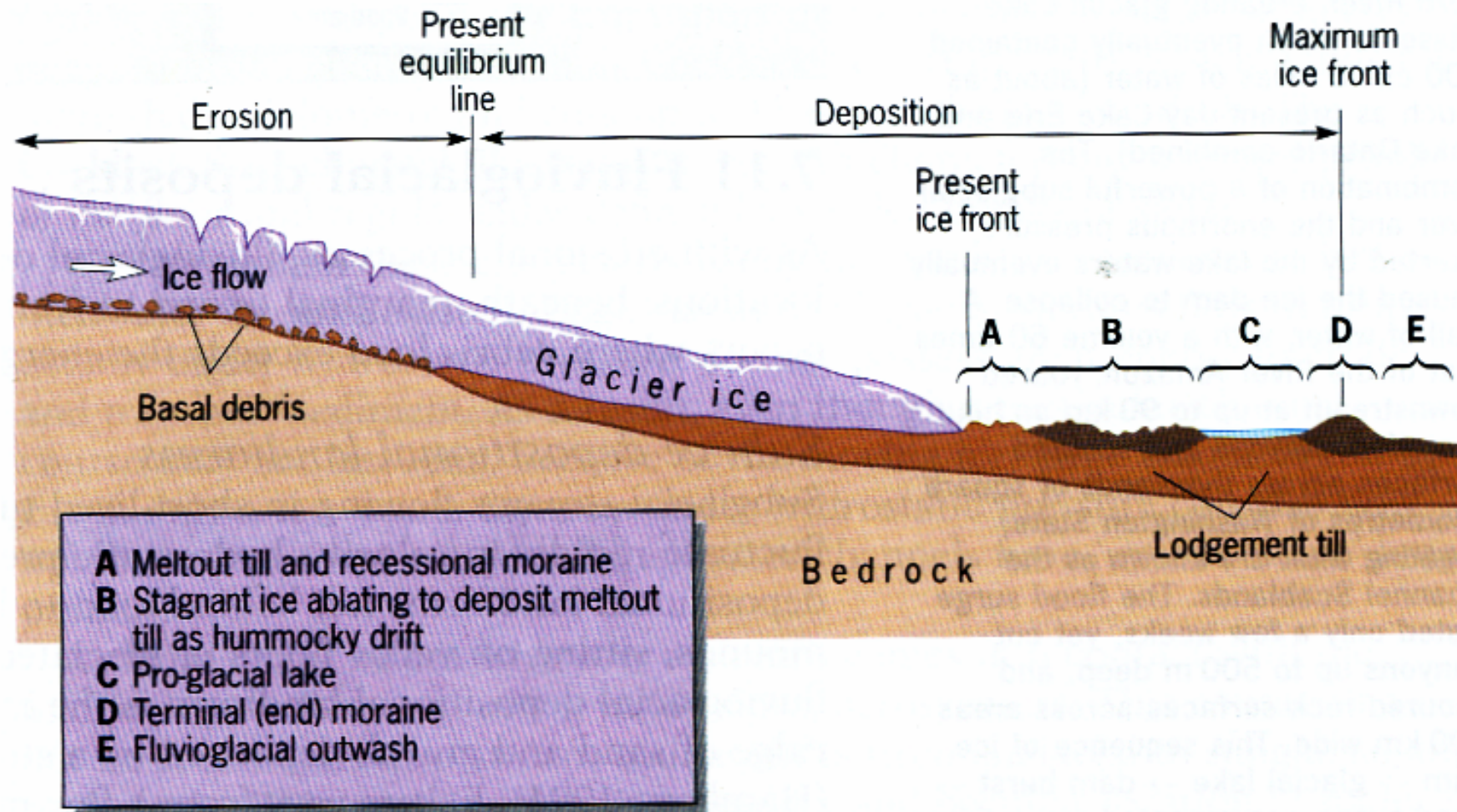
B) Moraine dammed lake

C) Drumlins

D) Lateral moraine

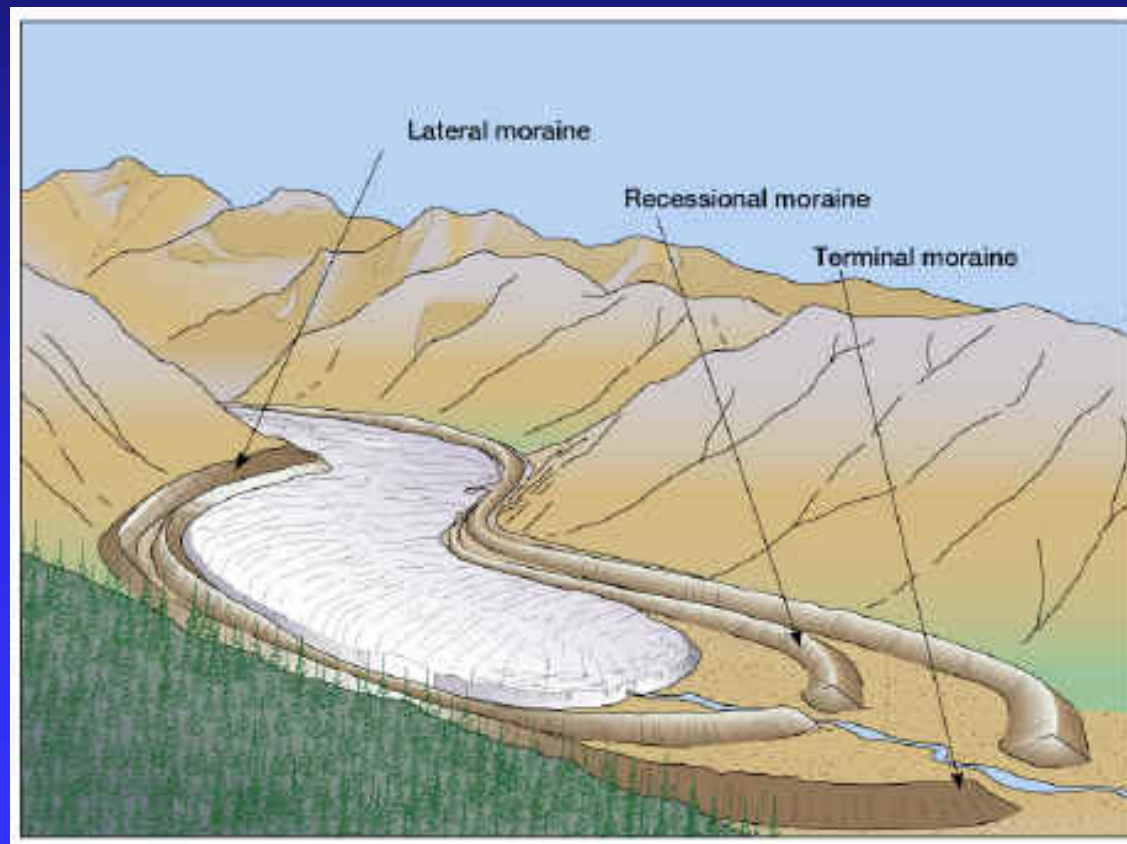
E) Recessional moraine

# Typical glacial Deposits During the Recessional Phase



## Moraines

Moraines are landforms created at the margins of glaciers by the melt-out of debris from the glacier and by the bulldozing action of the ice. Moraines are classified according to their position relative to the former glacier.





A retreating glacier exposes recessional moraine deposits



## Terminal moraines

*End moraines, or terminal moraines mark the end of a glacier; several may run in arcs and mark former positions of a glacier front. They are ridges of till, not usually higher than 20 m. In plan, they often form a series of crescents, corresponding with the lobes of the glacier; a well-developed example indicating that the ice front was at that location for some time. Not all former ice fronts are marked by terminal moraines; some may have been destroyed by meltwater.*

Major moraines  
on the western  
flank of Glen  
Tromie in the  
Cairngorms



## Push Moraine

Push moraines are only formed by glaciers that have retreated and then advance again. The existence of a push moraine is usually evidence of the climate becoming poorer after a relatively warm period. Material that had already been deposited is shoved up into a pile as the ice advances, and because most moraine material was deposited by falling down not pushing up, there are characteristic differences in the orientation of rocks within a push moraine. A key feature enabling a push moraine to be identified is individual rocks that have been pushed upwards from their original horizontal positions.

## Recessional Moraine

Recessional moraines form at the end of the glacier so they are found across valleys, not along them. They form where a retreating glacier remained stationary for sufficient time to produce a mound of material. The process of formation is the same as for a terminal moraine, but they occur where the retreating ice paused rather than at the furthest extent of the ice.

## Push moraine



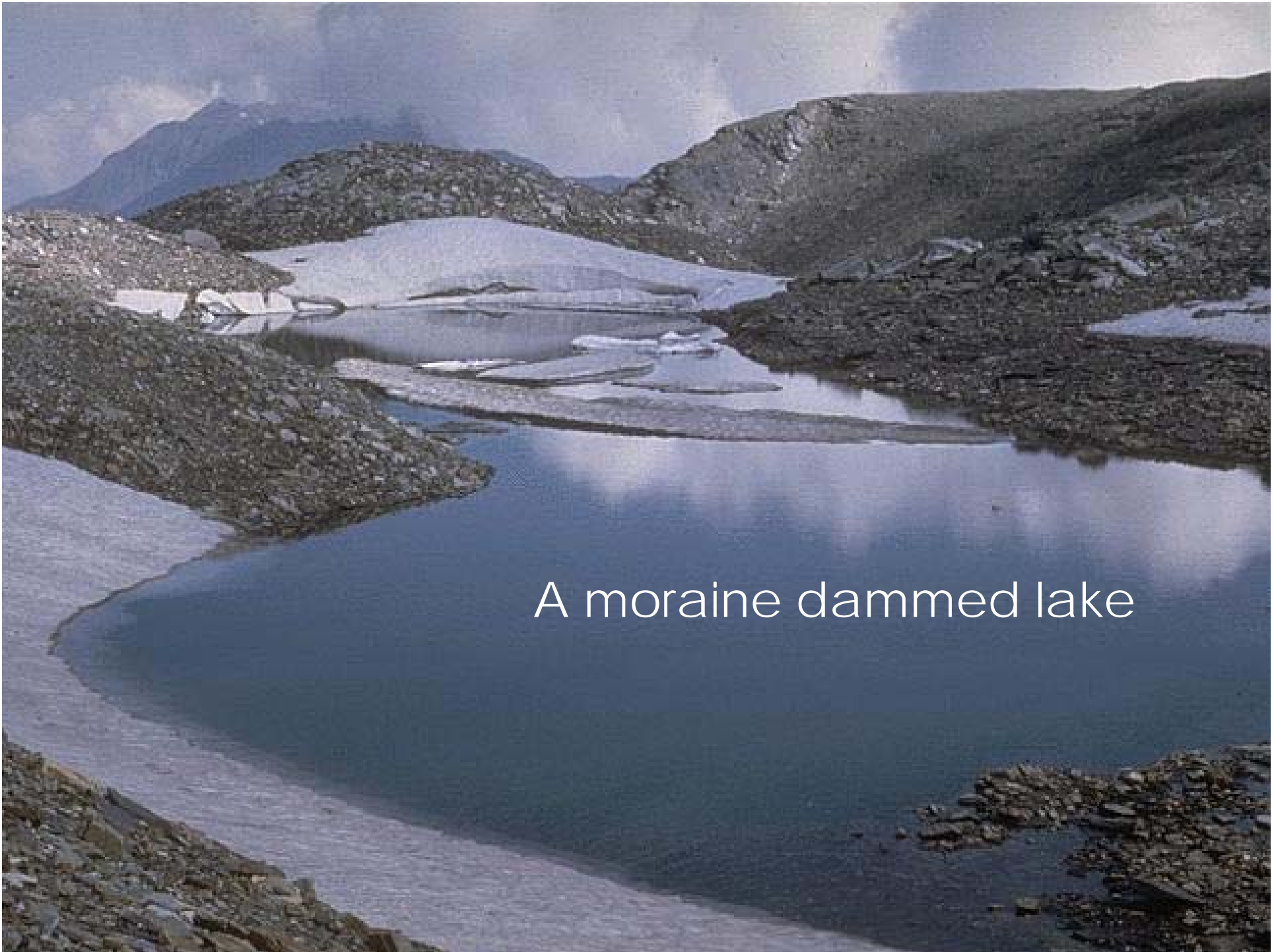
A recessional moraine in the French Alps. Scale is provided by the two climbers in the centre of the image.

## Lateral moraine

*Certain moraines are deposited at the side of the glacier as **lateral moraines**. Where two lateral moraines combine, a central, **medial moraine** may be formed.*

## Hummocky moraine

*A strongly undulating surface of ground moraine, with a relative relief of up to 10 m, and showing steep slopes, deep, enclosed depressions and meltwater channels. It results from the downwasting (i.e. thinning) of ice which may be stagnant or active. Blocks of ice may squeeze debris released from the ice into crevasses between the blocks.*



A moraine dammed lake



Old lateral moraine



Ancient lateral moraine







A valley glacier flowed down from the left to make this moraine near Leadville, Colorado. Several stages of retreat can be seen. At its height, the glacier merged with another one flowing down the valley in the background.



Moraines are where you find them, even in Peru. The latitude is 15 degrees south of the equator. The valley floor is at 4000m. The glacier is at about 5,000m

## Glacial Erratics



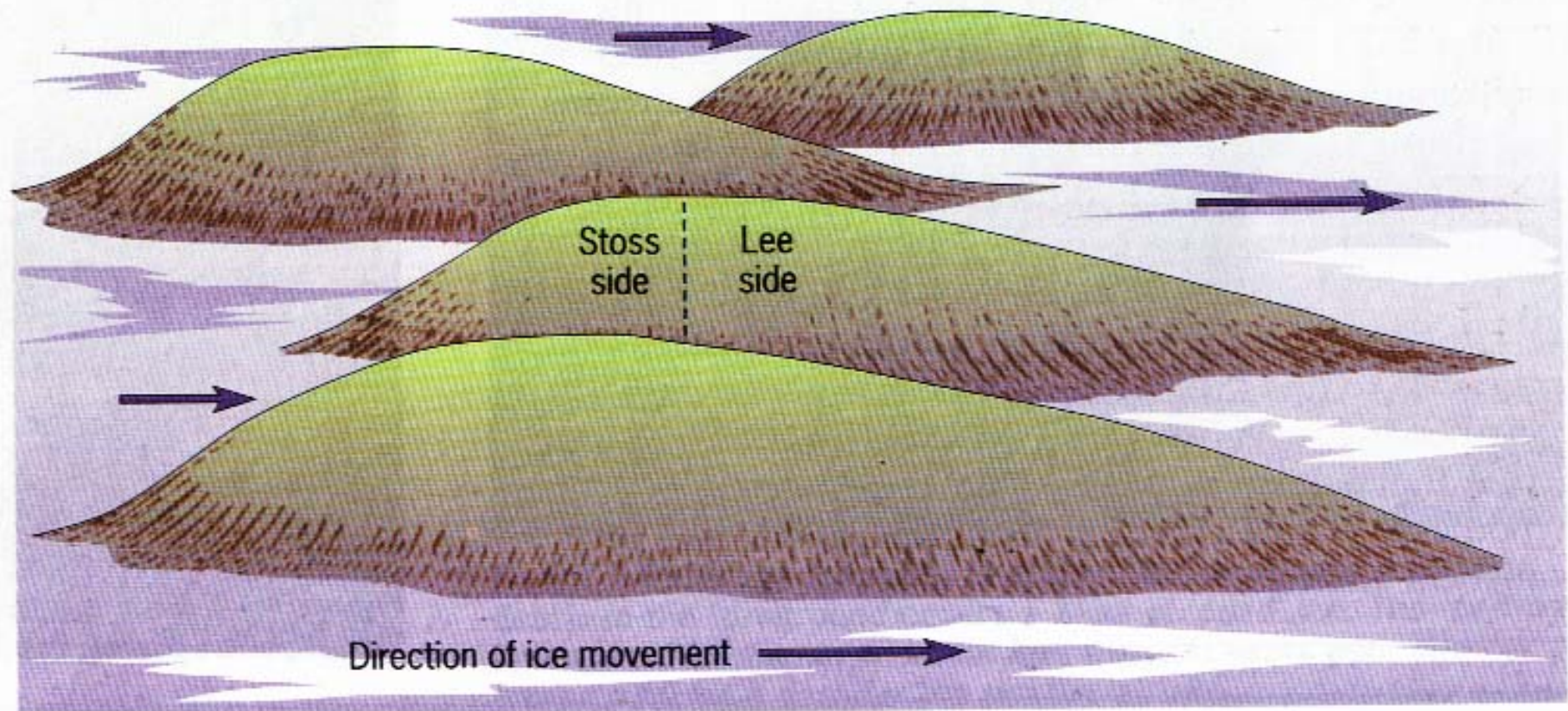
Science teacher Duane Leavitt next to Daggett's Rock in Phillips. This house-sized rock is the largest known glacially transported boulder in Maine. It has split into three pieces since coming to rest at its present location.

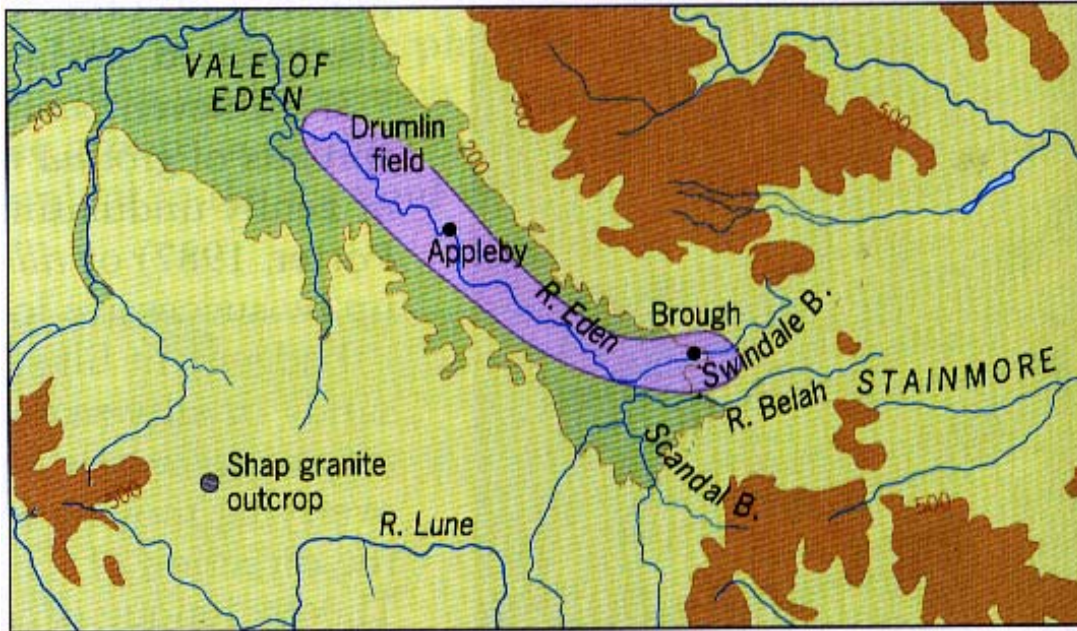


A Glacial Erratic in California

# Drumlins

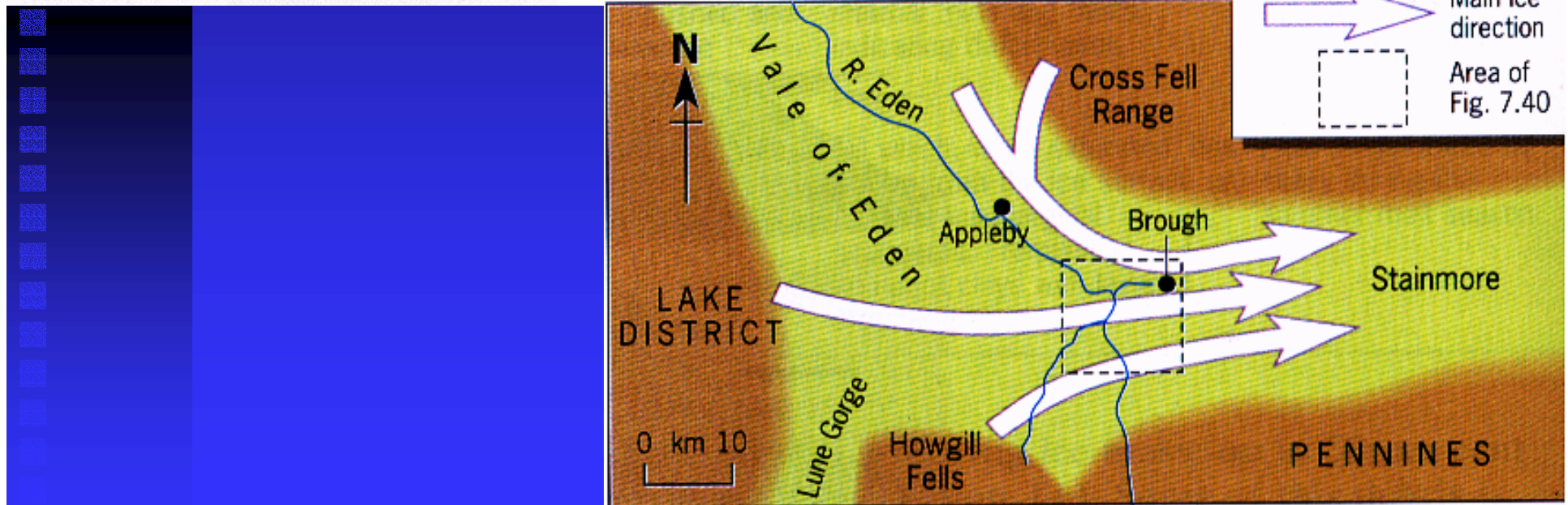
Drumlin shape in relation to the direction of ice movement



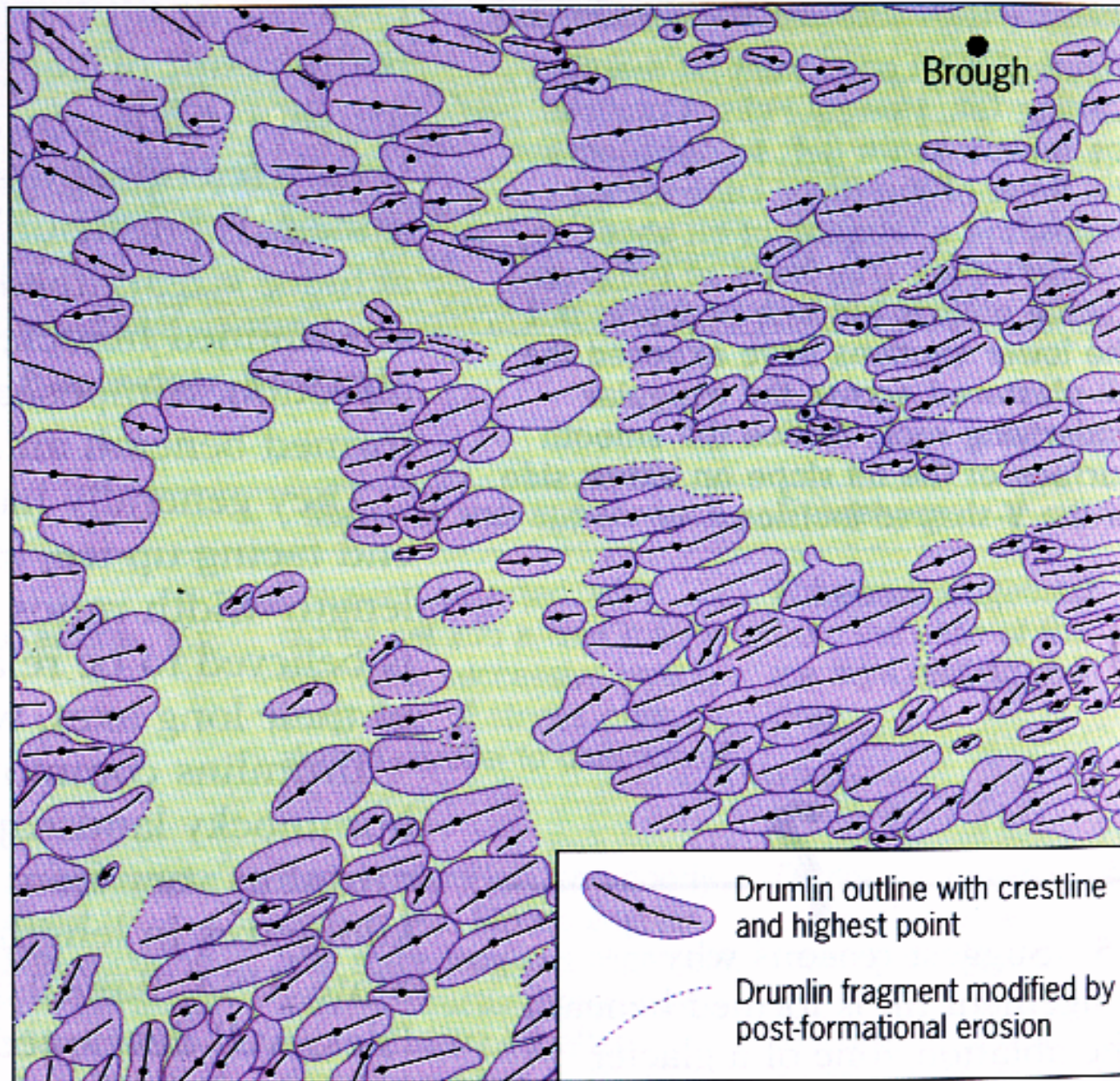


# Drumlin Fields in the Vale of Eden in Cumbria

The Vale of Eden drumlin field, Cumbria



Main ice sources and movements in the southern Vale of Eden during the Devensian Stadal



**Drumlin field near Brough, Cumbria. Each drumlin is shown by its planform, along with the crestline and highest point where these can be identified.**

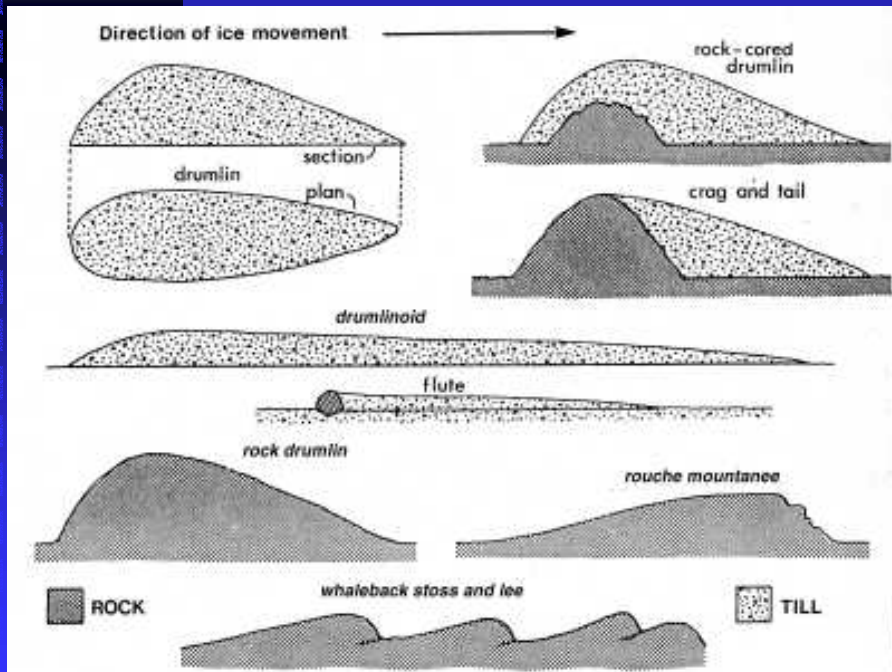
# Drumlin Field partially submerged by a lake in Wisconsin





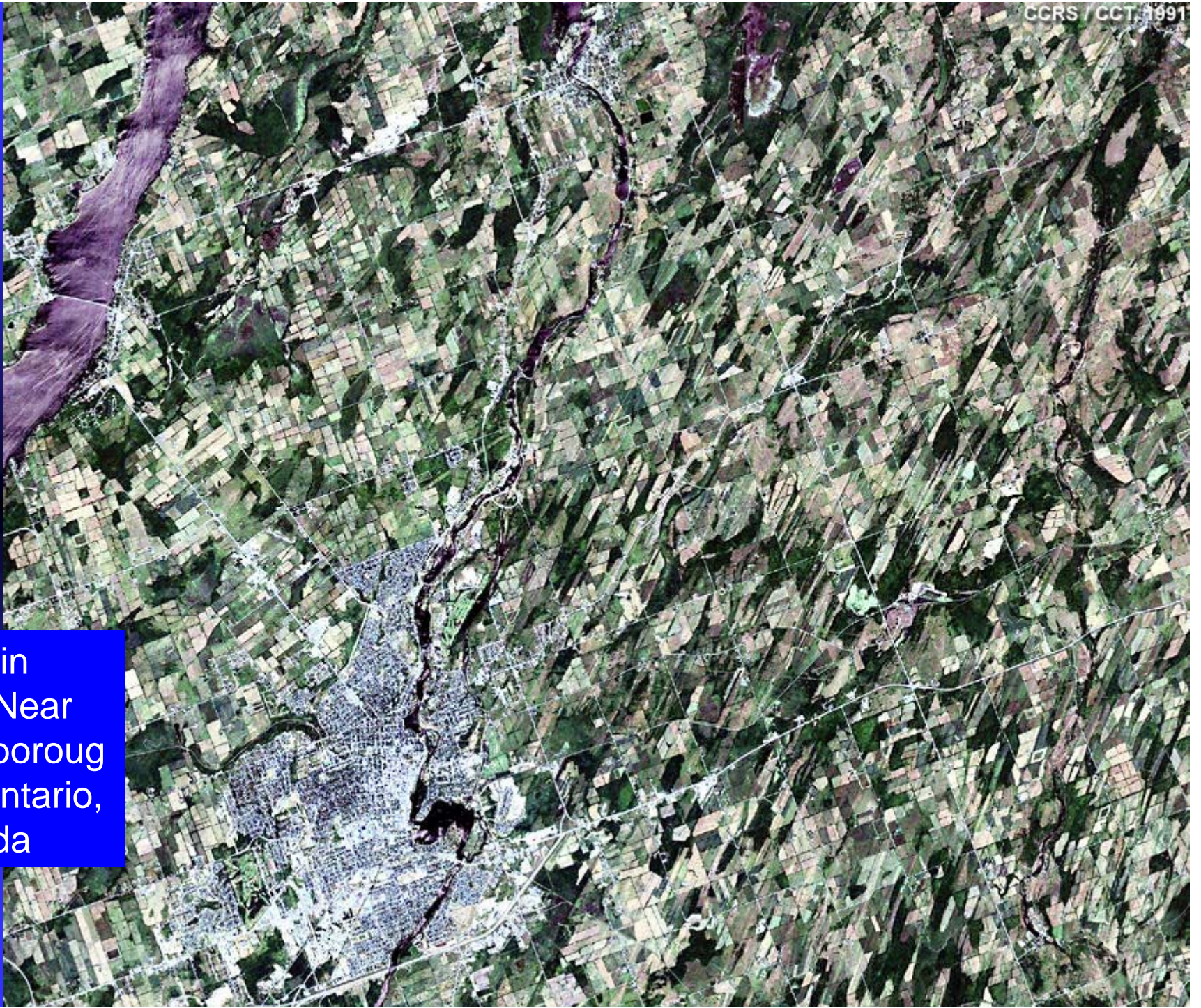
# Drumlin Field in Wisconsin





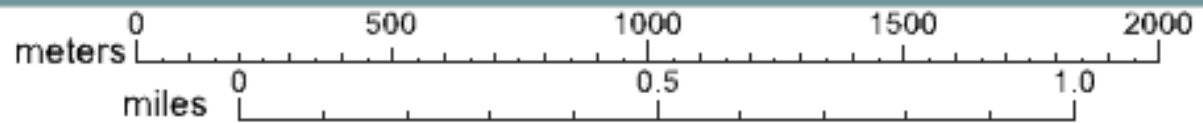
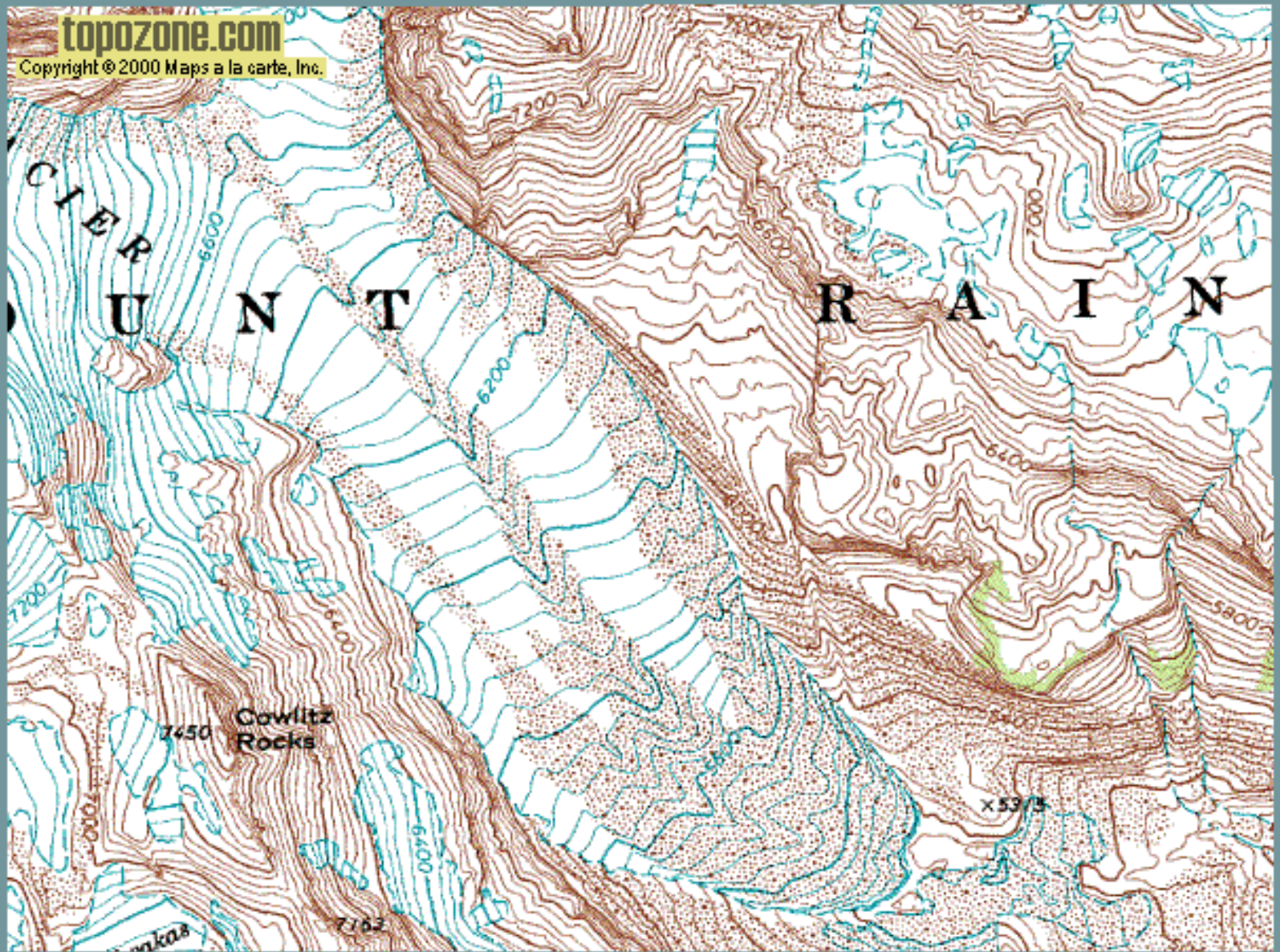


Freshly formed drumlins in the periglacial regions of northern Canada.

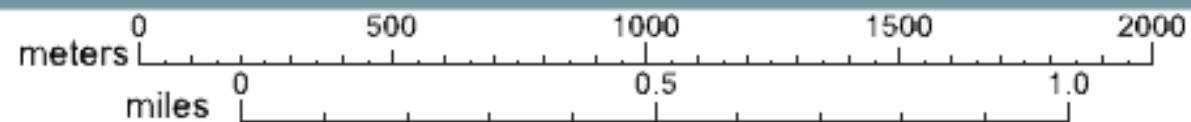
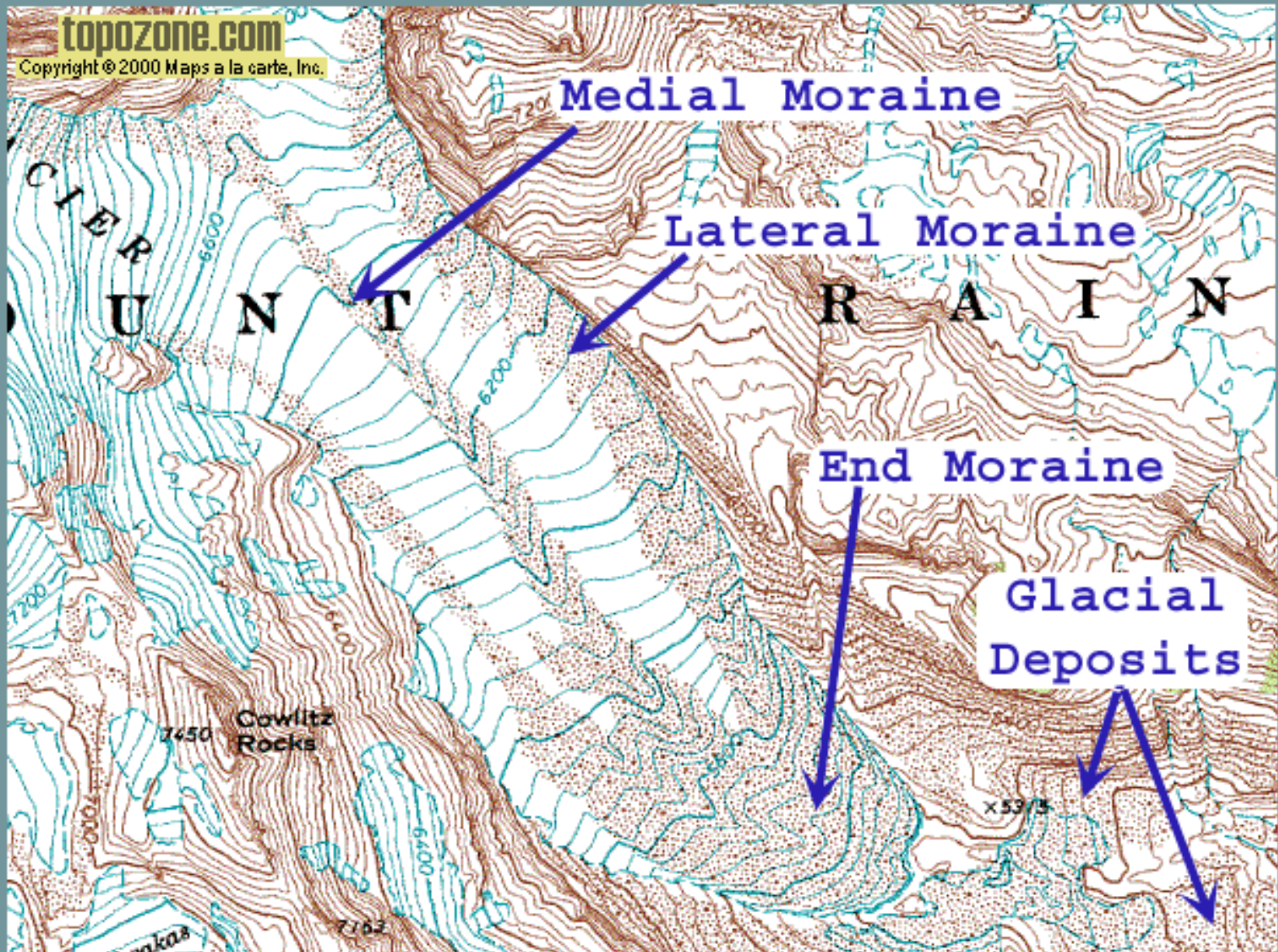


Drumlin  
Field Near  
Peterborough  
in Ontario,  
Canada

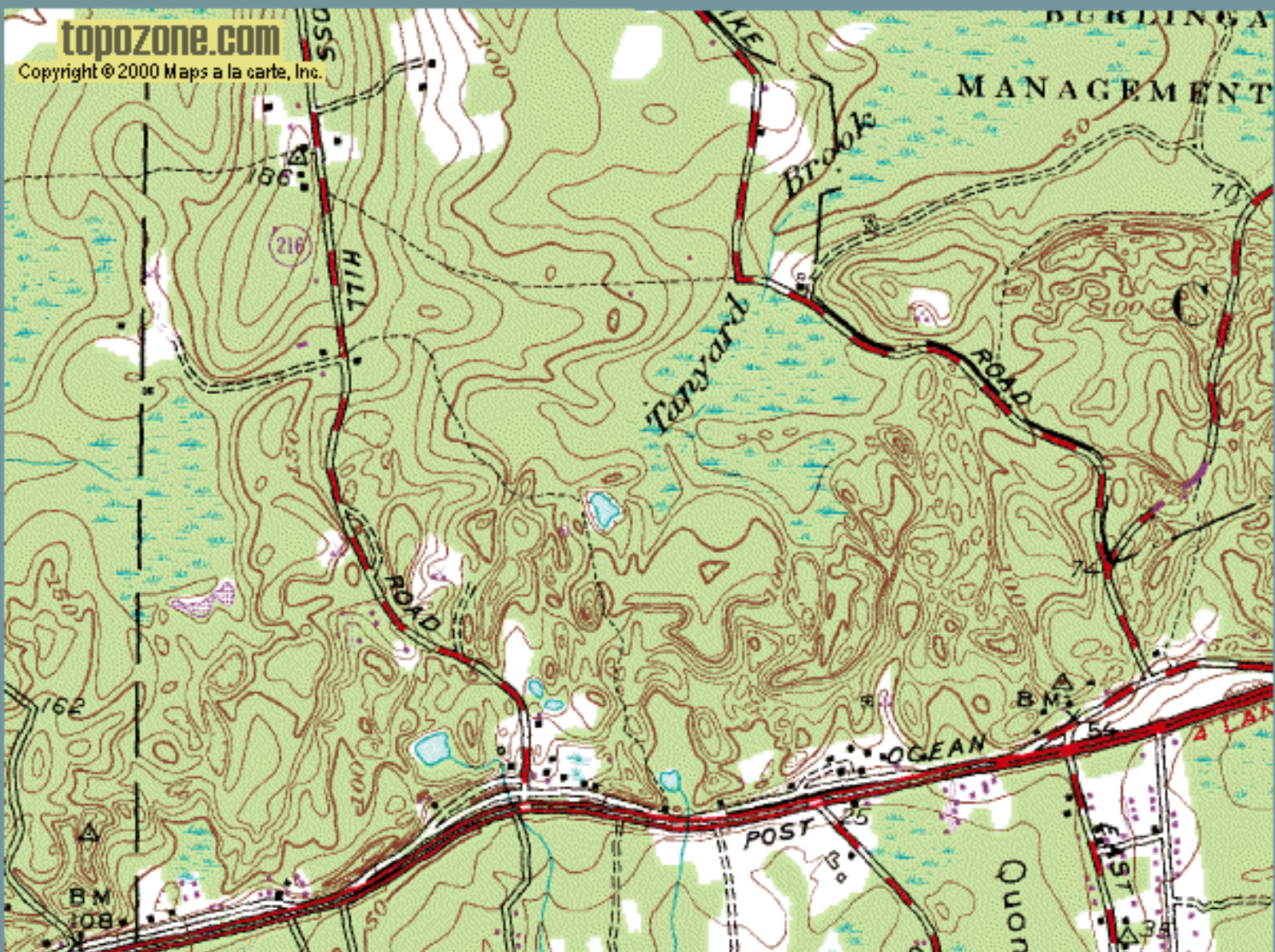
# Glacial Deposition on Maps



Map center is UTM 10 599945E 5185787N - MT RAINIER EAST quad

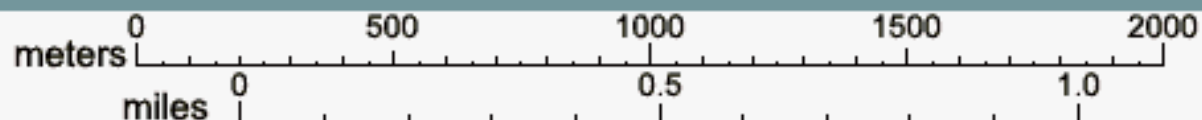
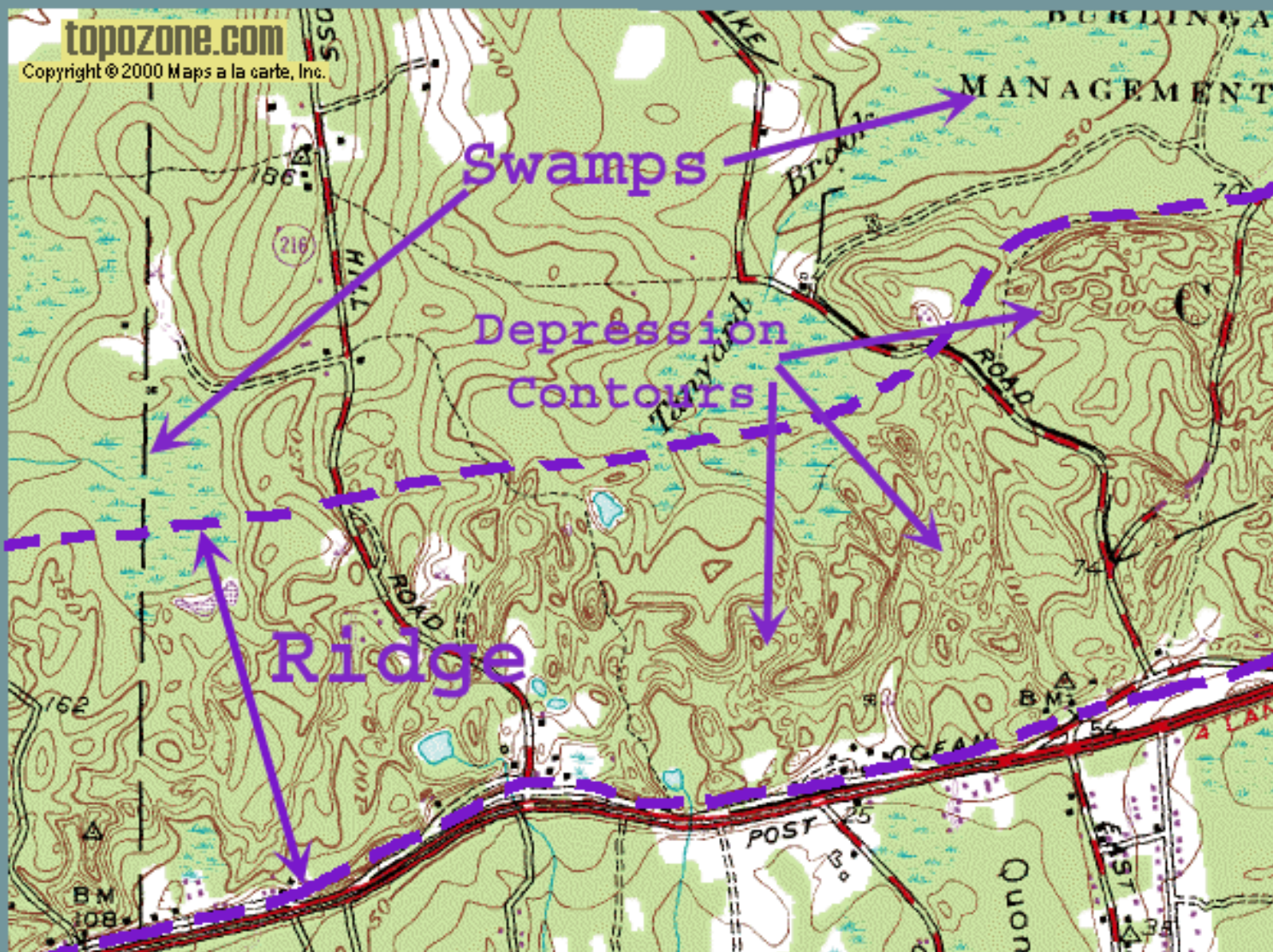


Map center is UTM 10 599945E 5185787N - MT RAINIER EAST quad

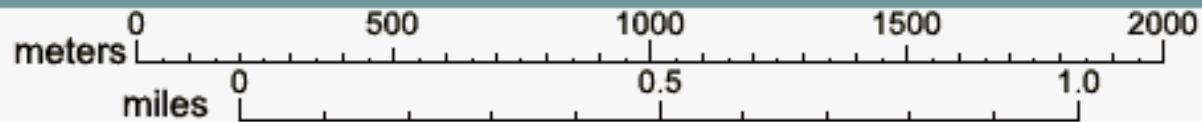
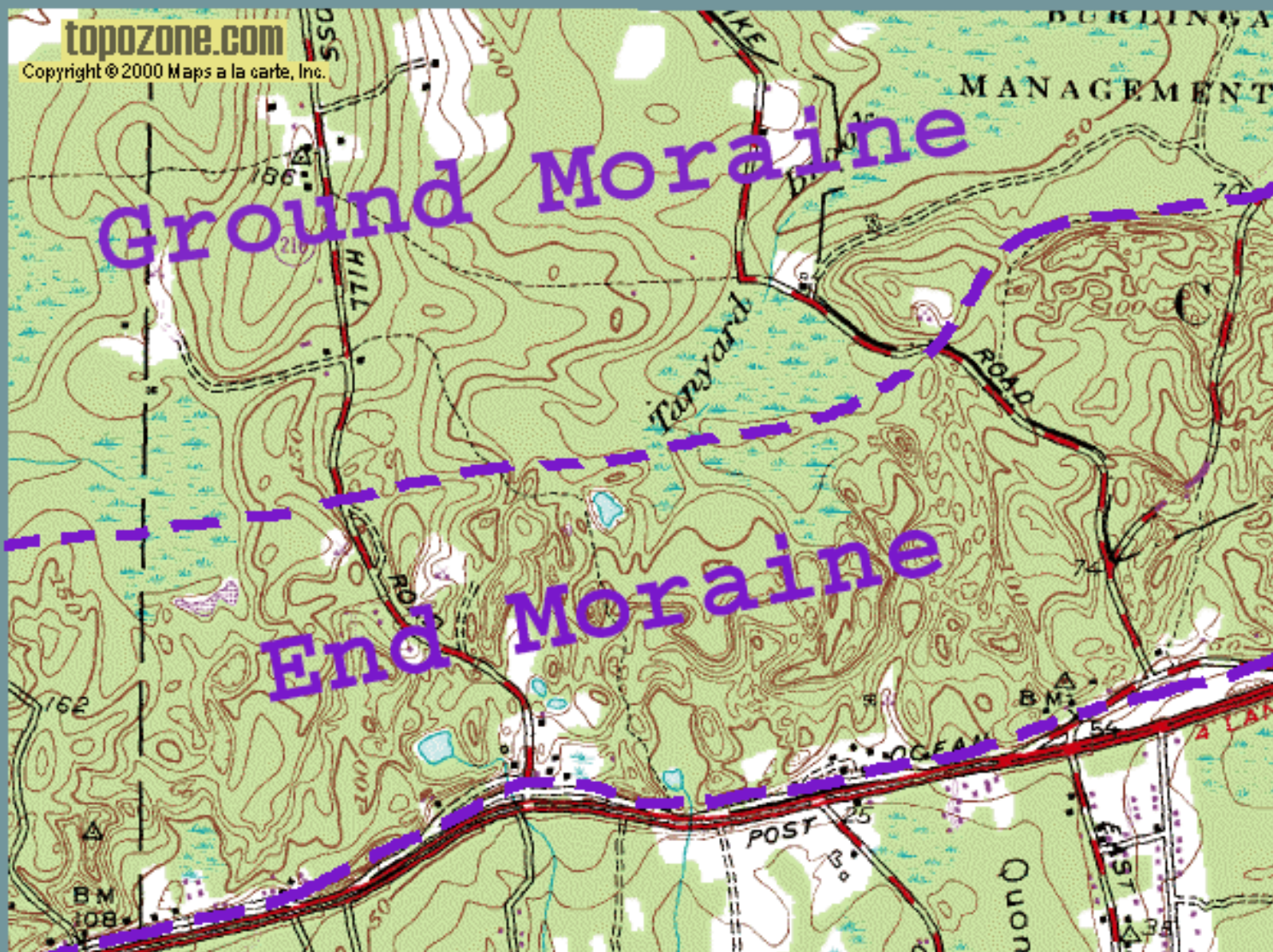


Map center is UTM 19 272796E 4582287N - QUONOCHONTAUG quad





Map center is UTM 19 272796E 4582287N - QUONOCHONTAUG quad



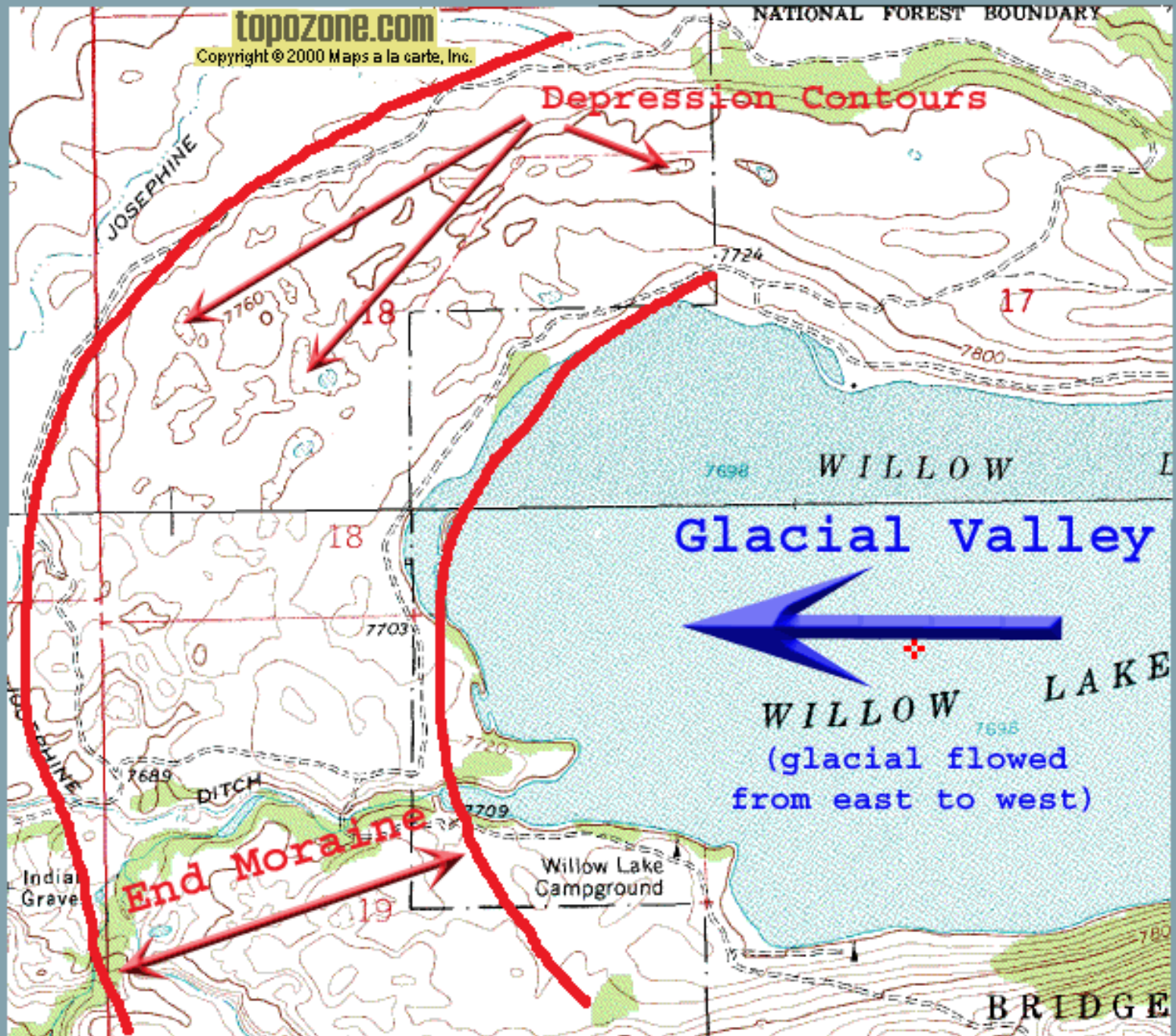
Map center is UTM 19 272796E 4582287N - QUONOCHONTAUG quad

topozone.com

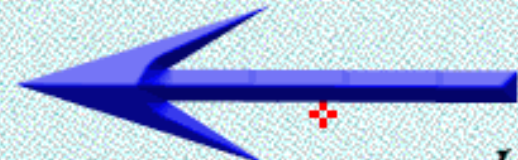
Copyright © 2000 Maps a la carte, Inc.

NATIONAL FOREST BOUNDARY

Depression Contours



Glacial Valley



WILLOW LAKE  
(glacial flowed from east to west)

End Moraine

BRIDGE

1:25,000 1:50,000 1:100,000 1:200,000

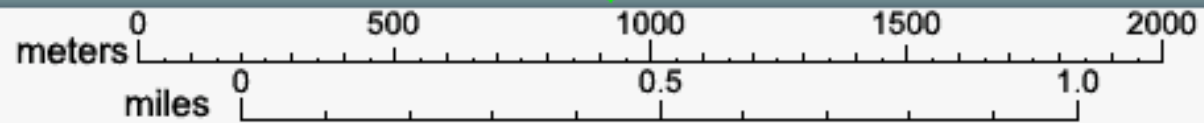
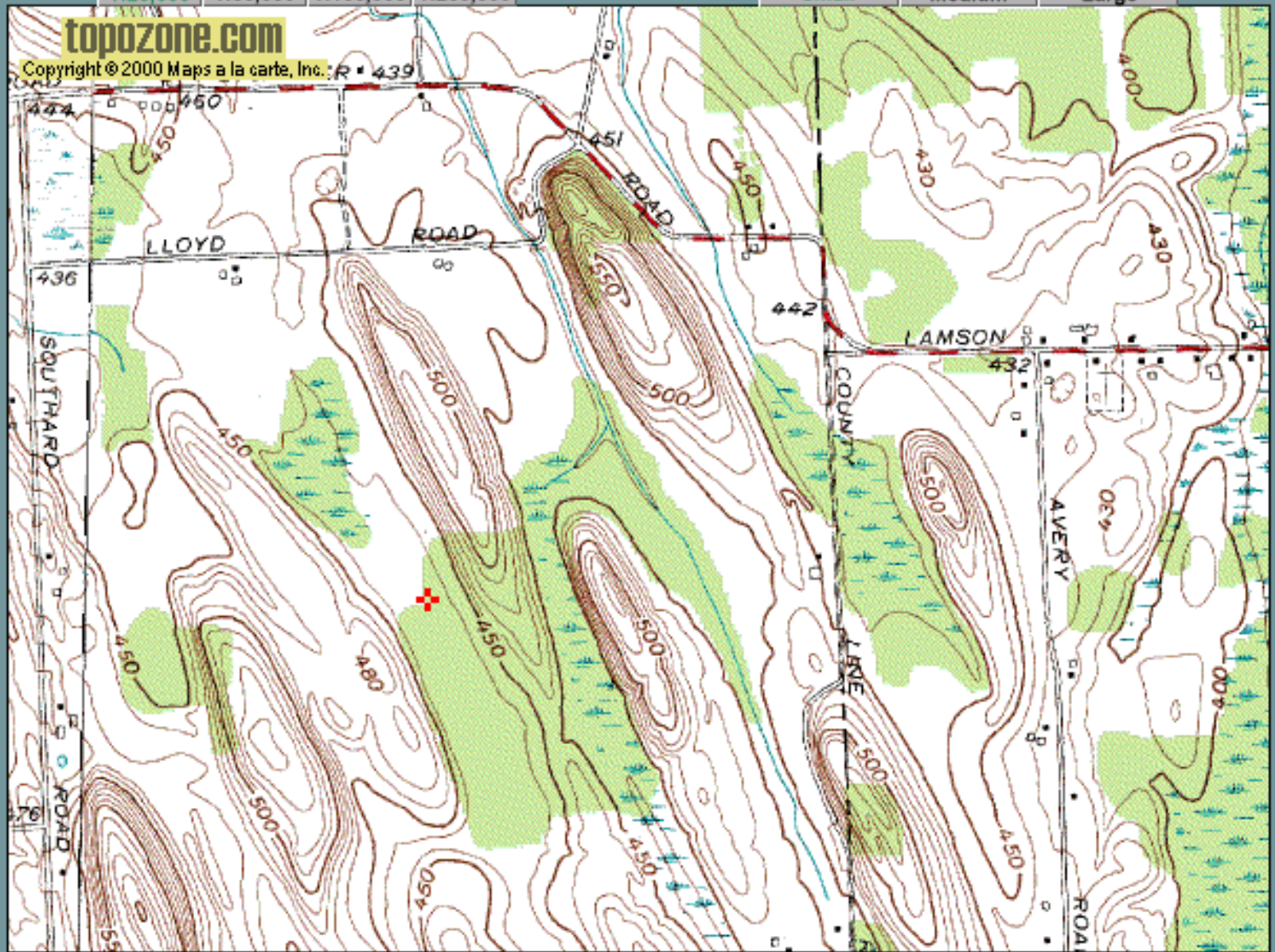
Small

Medium

Large

topozone.com

Copyright © 2000 Maps a la carte, Inc. R 439



Target is UTM 18 378972E 4783927N - LYSANDER quad

1:25,000 1:50,000 1:100,000 1:200,000

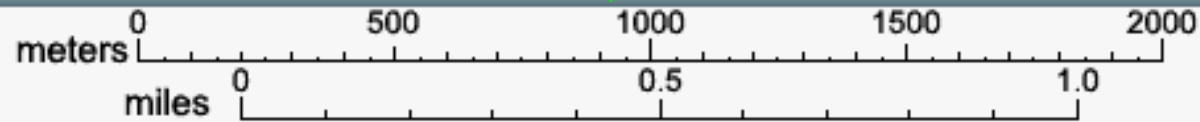
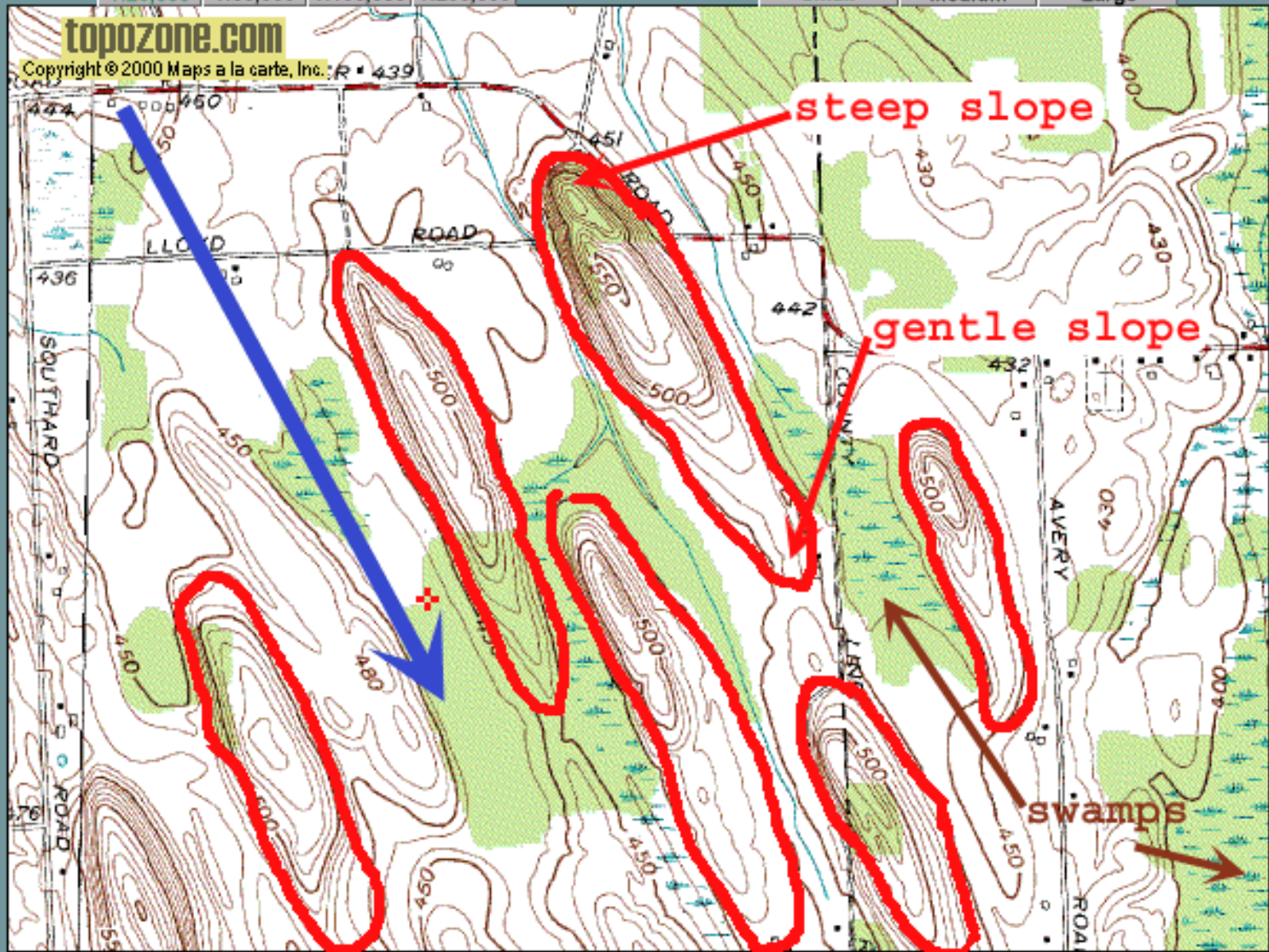
Small

Medium

Large

topozone.com

Copyright © 2000 Maps a la carte, Inc. R 439



Target is UTM 18 378972E 4783927N - LYSANDER quad

## Human Activity in Areas subject to **Glacial Deposition:**

Consider the impact of the landscape on:

- Agriculture
- Settlement & Communications
- Recreation and Tourism

# Agriculture

## Advantages

Ground moraines can enhance agricultural activity. In East Anglia, till deposits up to a depth of 140m overlie the chalk bedrock. A deep, fertile soil has formed in the chalky till. Heavy clay soils are used for pasture and lighter soils are used for arable farming (sugar beet, grain and potatoes)

## Disadvantages

In upland areas, till deposits (such as terminal moraines and ground moraines, can create “hummocky ground” which restricts mechanised farming.

Where large erratics occur in large numbers, these can also restrict mechanised farming.

# Settlement & Communications

## Advantages

Areas of widespread glacial deposition, such as East Anglia, generally favour settlement location and the construction of transport links. They offer no significant relief restrictions and there are usually many suitable dry sites.

## Disadvantages

Glacial sediments are generally unconsolidated and are therefore prone to erosion. Glacial tills on the Holderness coastline of Yorkshire are prone to erosion rates of 2-5m per year, this threatens coastal settlements (such as Hornsea or Withernsea), industrial sites (such as the Easington Gas Terminal) and transport links such as coastal roads.



# Recreation and Tourism

## Advantages

Terminal moraines can create moraine-dammed lakes. In Northern Italy, terminal moraines have helped to create lakes such as Lake Garda and Lake Como. These lakes are important tourist attractions in the Italian lake District.

The Cromer Ridge in East Anglia, which is thought to be a complex terminal moraine relating to the last Devensian Glacial, is an important local recreational area for walking, cycling and other outdoor activities.

## Disadvantages

Areas of glacial deposition do not have the extremes of relief and landscape attractions that attract visitors to areas of glacial erosion.

