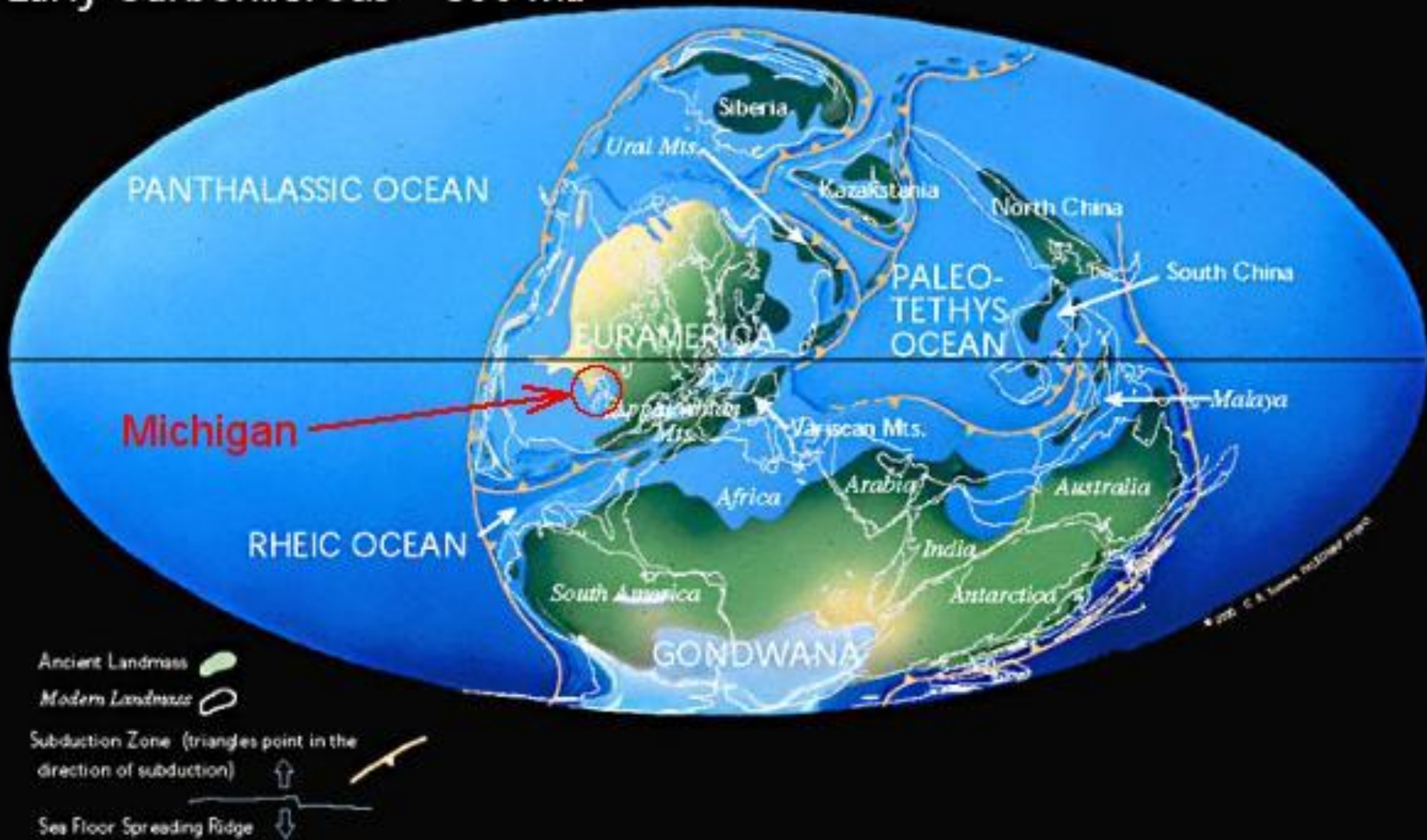
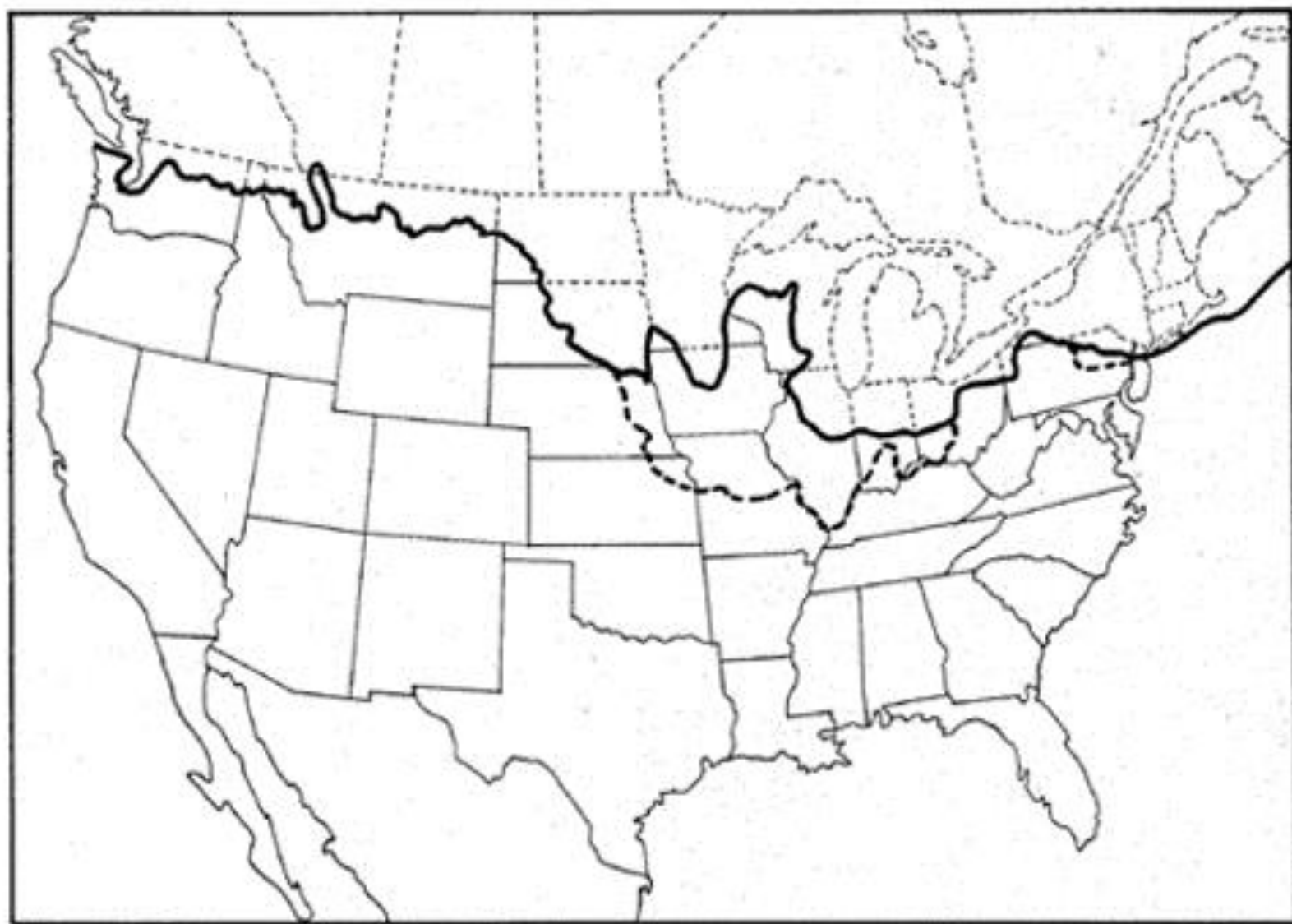


# Michigan Geologic History



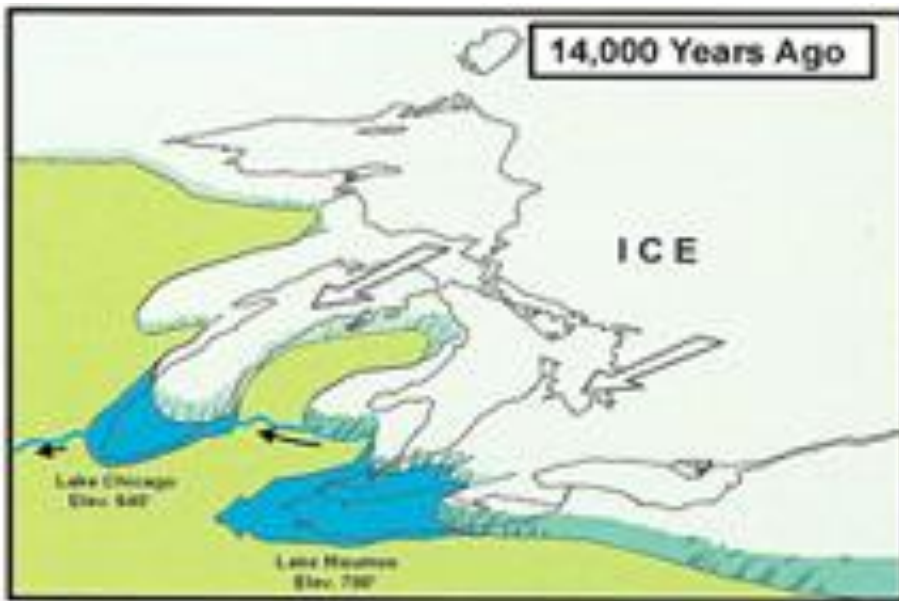
# Early Carboniferous 356 Ma







14,000 Years Ago



9,000 Years Ago



7,000 Years Ago



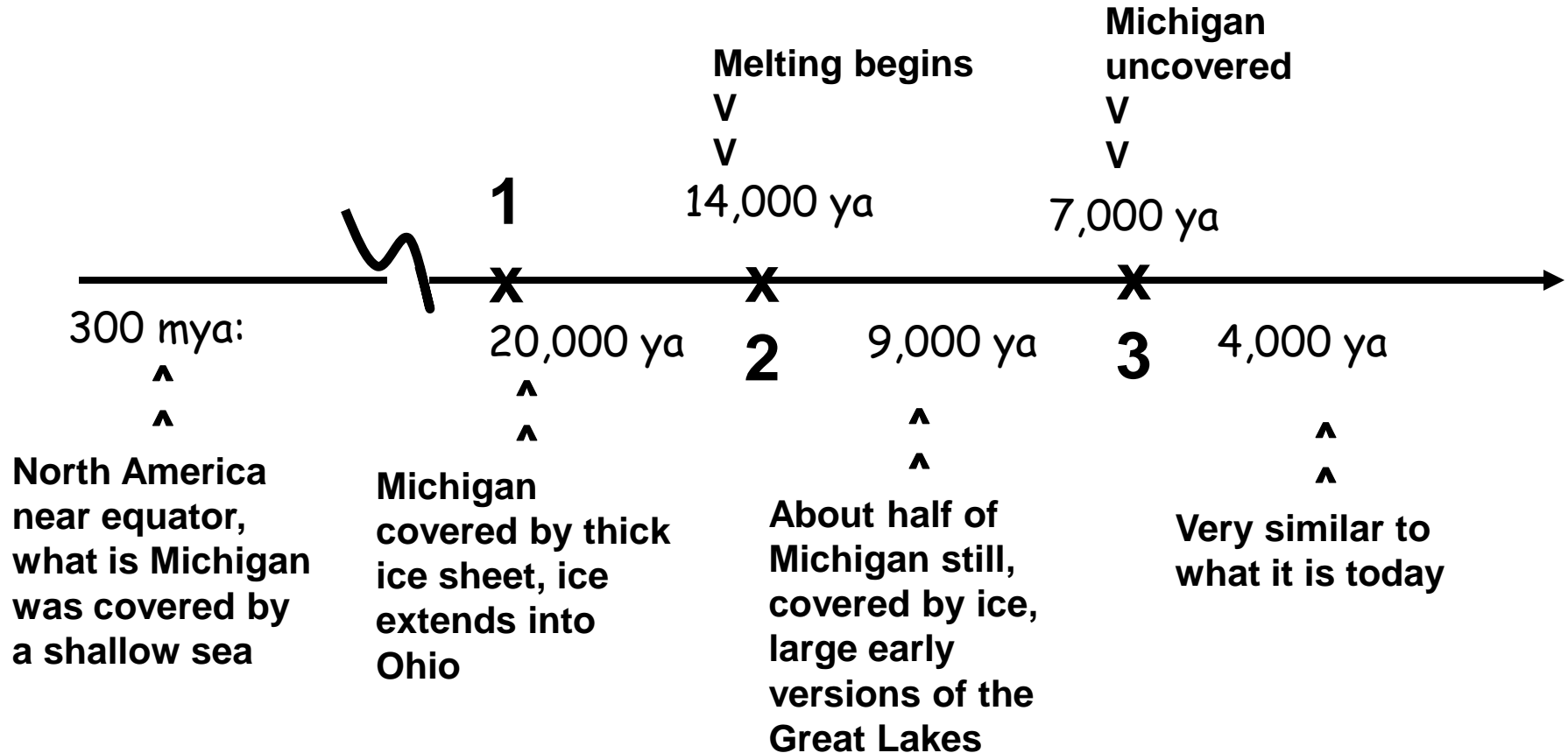
4,000 Years Ago



# Michigan Geologic Timeline

## Reference points

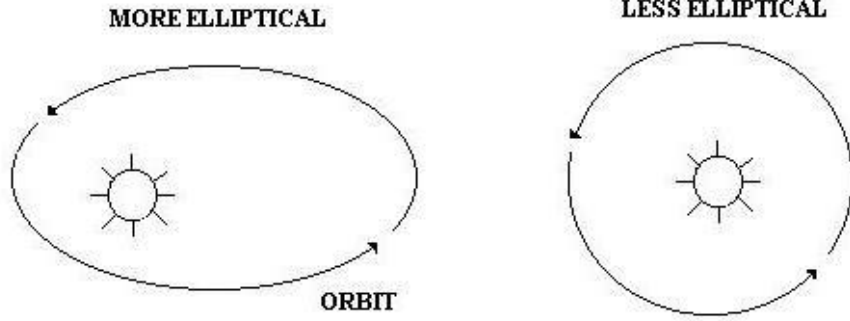
1. Earliest human evidence on American continent
2. Start of Agriculture (evidence in the Middle East)
3. Egyptian civilization (beginnings)



# What do you know about the Ice Ages?

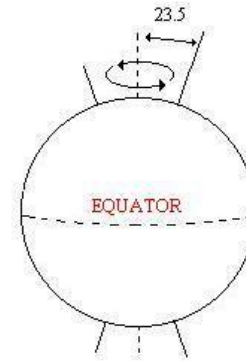
- **Period of cold: ice caps from poles expand far south (or north from south pole)**
- **Animals associated: woolly mammoths, mega fauna like saber-toothed tigers, “cavemen”**
- **Last ICE AGE ended about 12,000 y.a.**
- **There have been MANY ice ages in Earth’s history**
- **Michigan and the Great Lakes were shaped by the last ICE AGE**

## ECCENTRICITY

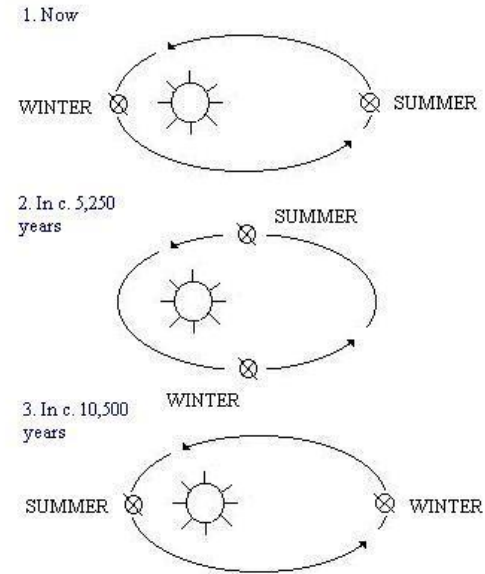


**PERIODICITY:**  
**100,000 YEARS**

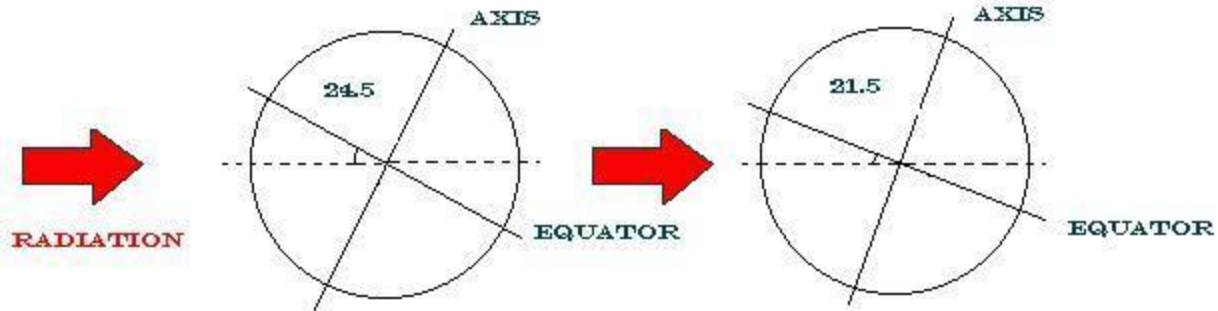
## PRECESSION



**PERIODICITY:**  
**C. 23,000 YEARS**



## AXIAL TILT



**PERIODICITY:**  
**41,000 YEARS**



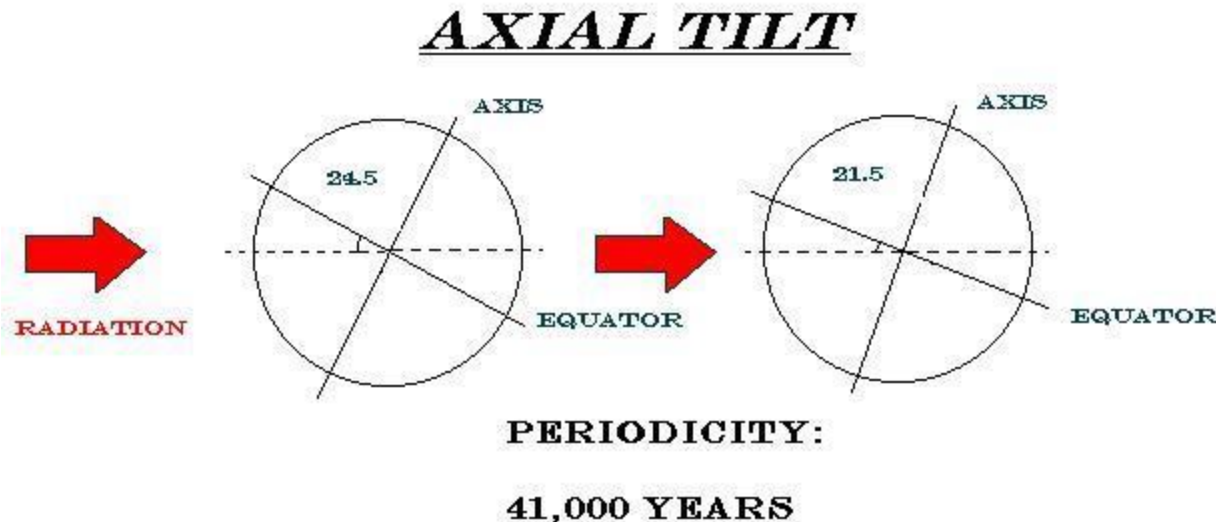
# *Causes of Ice Ages*

## 1-Milankovitch Cycles

**Axial tilt (Obliquity)**- the tilt of Earth changes slightly over time.

Tilt ranges from 24.5 degrees to 21.5 degrees.

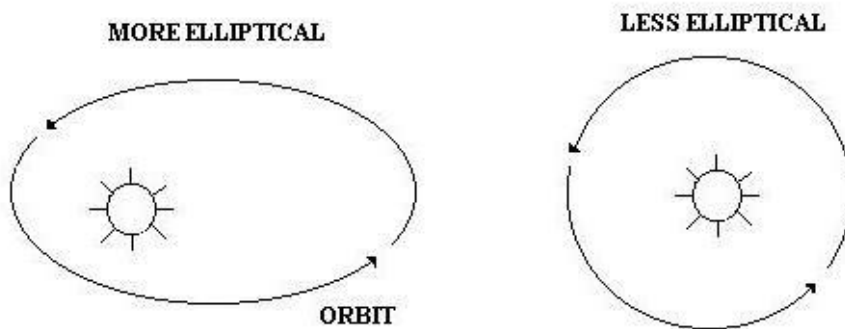
**Changes amount of direct or indirect rays (seasons, zones)**



# *Causes of Ice Ages*

## 1-Milankovitch Cycles

### ECCENTRICITY



PERIODICITY:

100,000 YEARS

**Eccentricity**- the orbit of Earth around the sun changes due to gravitational pull over time.

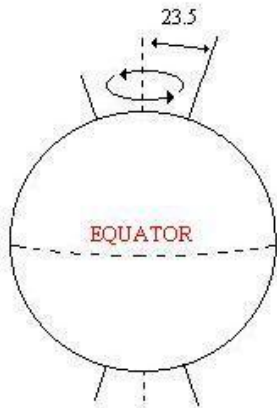
The orbit goes from almost circular to more elliptical.

**Changes amount of heat energy**

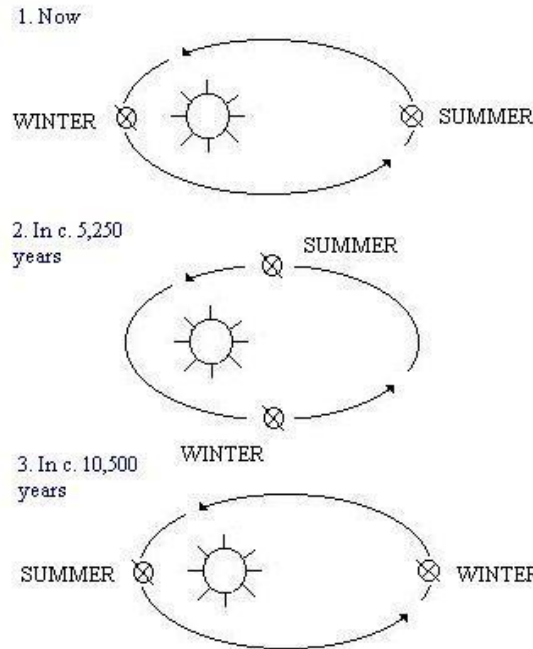
# Causes of Ice Ages

## 1-Milankovitch Cycles

### PRECESSION



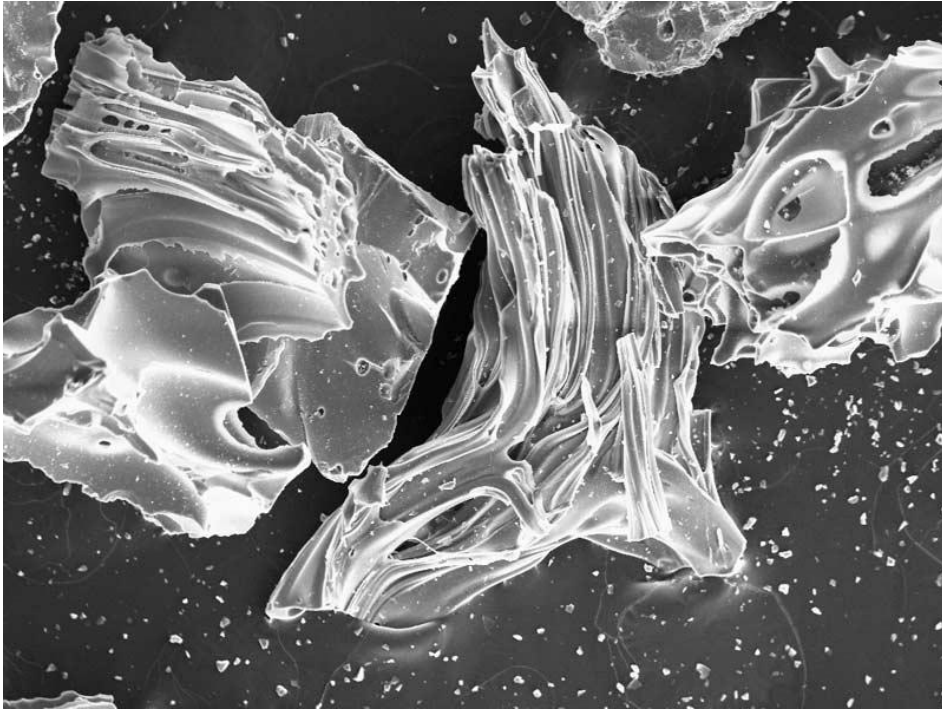
PERIODICITY:  
C. 23,000 YEARS



Precession- as the Earth rotates the axis changes position in relation to the sun  
This is also known as "wobble" (like a spinning top)  
**Changes when seasons occur**

# *Causes of Ice Ages*

## 2- Volcanic eruptions



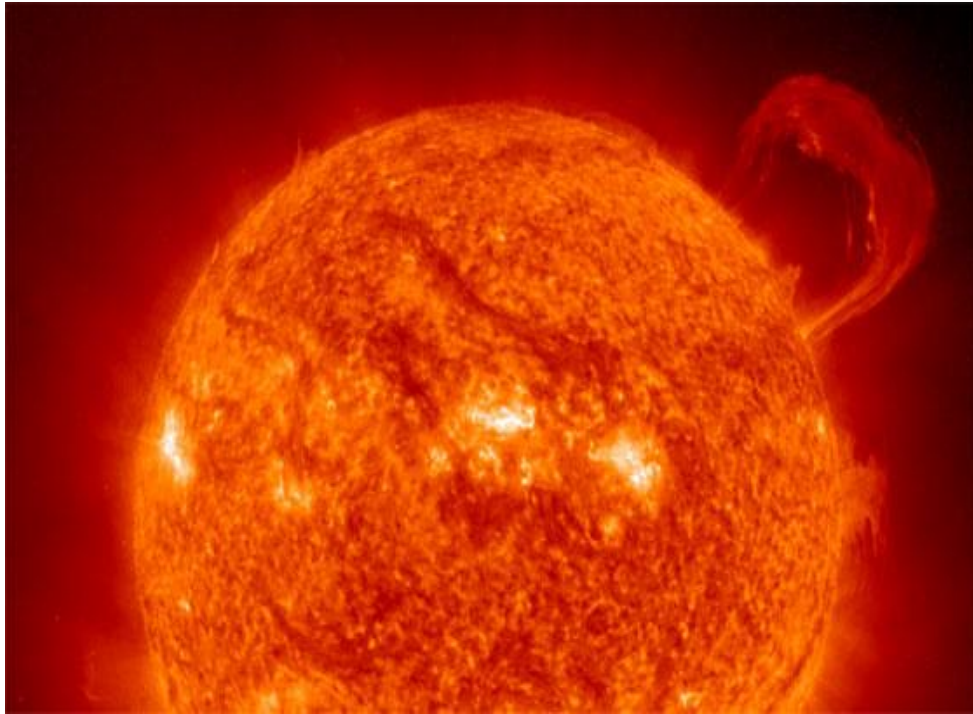
Volcanic ash-goes into atmosphere and blocks the sunlight

Not as long lasting

**Changes the amount of heat reaching Earth's surface**

# *Causes of Ice Ages*

## 3- Solar Output



Sun puts out different amounts of heat radiation (could be more, could be less)

Not as long lasting

**Changes the amount of heat reaching Earth's surface**