Earth Changers
Teacher Background Information (SC080100)

This unit asks students to look around their own neighborhood to see signs of geologic processes in action now and those processes that shaped the land in the past. Although this Teacher Background can provide some information to help the teacher and students do that, to do a good job every teacher will need to do personal research into his/her own community. We have provided some clues to various avenues you can take and some transparencies to begin your preparation.

The greatest area of misconception a teacher encounters in a unit of this type is a student's perception of time. Therefore the development of a timeline is a key lesson. As you question students throughout the unit, ask, "Did ___ happen before or after ___?" "A little bit of time or a lot?" and encourage them to refer to the timeline they develop.

An excellent visual aide for the unit is a class timeline. If you have a traditional corkboard above your chalkboard, begin with photos and images there. But be careful to keep it proportional. (*/9 of Earth's history occurred before the first multi-cellular organisms existed.)

As a resource, contact the Department of Environmental Quality in Lansing for the CD-ROM, *The Rock Cycle in Michigan*. In addition to the PowerPoint Presentation on the Rock Cycle (which also can be found at *Grade 7 Unit 5 Lesson 4 Teacher Background*) you receive PDF files with many images and additional information concerning Michigan Geology. The DEQ staff there will also answer specific questions about Michigan Geology.

Transparency Masters

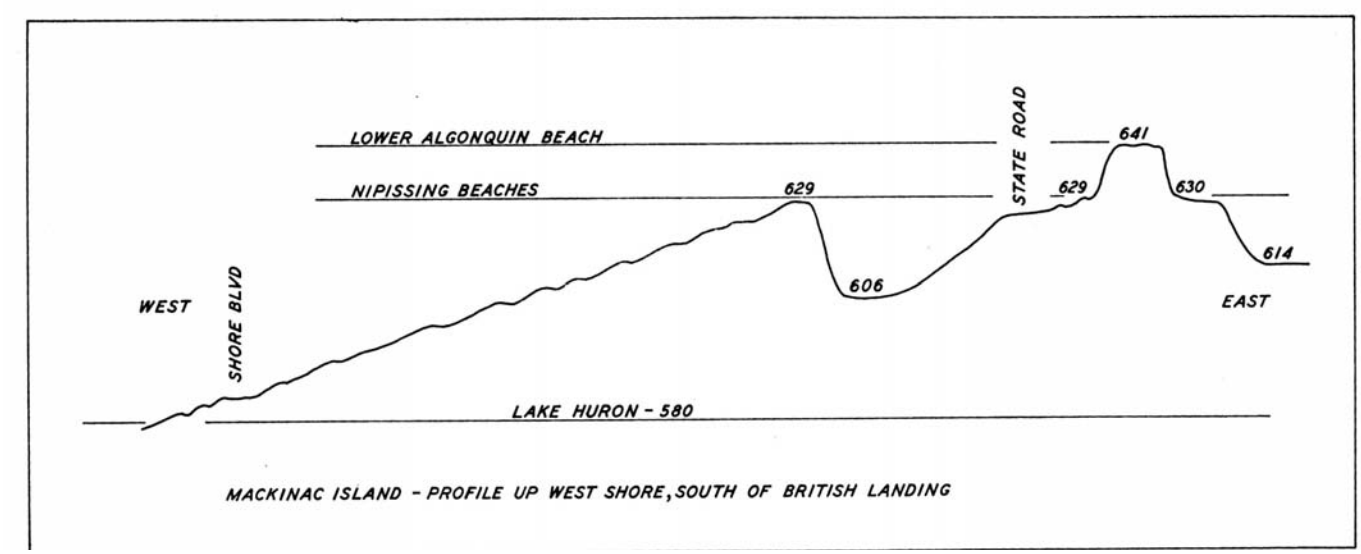
Layer	**Thickness**	**Composition**	**Other Properties (Temperature, Density)**
Lithosphere	5-100 km Crust is thickest under continents, thinnest under oceans. Divided into plates.	Soil, rock	The deepest mine is a gold mine in South Africa (3.8 km). For every 40 km deeper than 20 m, the temperature rises about 1^{o} C. The pressure increases the deeper you go.
Mantle-Asethenosphere	250 km	Molten rock	Cooler than the rest of the mantle. Soft layer of mantle that moves slowly. 870^{o}C
Mantle-Mesosphere	2550 km	Silicon, oxygen, iron, and magnesium	More rigid than the rest of the mantle. Convection currents move heated material closer to surface and as it cools the material becomes more dense and sinks toward the center.
Outer Core	2200 km	Iron and nickel	Thick liquid 2200^{o}C
Inner Core	1228 km	Iron and nickel	Solid metal. Pressure is so intense the atoms are pushed together and cannot spread apart in spite of the temperature.

YEAR	**SUMMARIZE WHAT HAPPENED TO SUPPORT THE THEORY OF CONTINENTAL DRIFT**
1620	Francis Bacon was an English philosopher who promoted the use of scientific investigation and deductive reasoning and suggested the idea that the continents once fit together. This is the same Francis Bacon who some people thought wrote Shakespeare's plays.
1911	Alfred Wegener, a German meteorologist, formally proposed the Theory of Continental Drift. Using his own findings and those from other investigators, he assembled evidence for this theory in a logical manner. Many people did not accept this theory since there was no real suggestion as to how continents could have moved.
1960S	American scientists aboard the *Glomar Challeneger* found evidence of sea-floor spreading. This left the question, "If the sea floor is getting bigger, then why isn't the whole lithosphere getting bigger? This question was later answered with subduction and recycling of the earth's crust.
TODAY	Scientists are examining the relationships among the lithosphere, mantle, and core to better understand the sources of heating (radioactive?), convection cells throughout the mantle, and applications to other bodies in space. Better maps of plate edges and measurements of movement are also sought.

GEOLOGIC TIME TABLE

ERA	PERIOD	RECORD OF CHANGE	MILLIONS OF YEARS AGO
CENOZOIC ERA — Age of Mammals	Quaternary	Modern Man Great Lakes formed after Ice Ages	1.5
	Tertiary	Early man; Grasslands with horses dominant. North and South America join. Rocky Mountains formed. Tethys Sea closed off.	65
MESOZOIC ERA — Age of Dinosaurs	Cretaceous	Mass Extinction Major continents formed. Pleisosaurs and sea turtles in oceans. Hardwoods grow (oak, maple); other angiosperms *Tyrannosaurus Rex; Triceratops*; hadrosaurs; ankylosaurs	140
	Jurassic	First mammals and first birds (*Archeopteryx*) Many dinosaurs (*Apatosaurus* and other sauropods*; Stegosaurus*) Pangaea starts to break apart	180
	Triassic	Trees with cones (conifers, cycads, ginkos) Crocodiles; turtles; pterosaurs; ichthyosaurs Appalachian Mountains formed; Pangaea; lots of volcanoes Time of the Lystrosaurus	240
PALEOZOIC ERA — Age of Amphibians / Age of Fishes / Age of Invertebrates	Permian	Mass extinction First reptiles; *Coelacanth*	280
	Carboniferous	Insects on land; More amphibians Coal starting to form; lungfish, Glossopteris plants.	350
	Devonian	First trees; Petoskey coral formed First amphibians; more fish with some in freshwater; Most of Michigan's lower peninsula was under a shallow sea, inhabited by *Hexogonaria* (the coral in Petoskey Stones) and brachiopods.	410
	Silurian	More land plants (ferns); jawed fish; placoderms; and sharks More marine invertebrates including ammonites	440
	Ordovician	First land plants; first fish (jawless) Sponges, snails, corals; crinoids	490
	Cambrian	Many invertebrates in ocean (trilobites and mollusks like brachiopods) Algae; no land plants	600
PRECAMBRIAN ERA	Precambrian	Few fossils (casts or molds of soft-bodied organisms) Photosynthesis puts O_2 in atmosphere Domains Eubacteria and Eukaria (about 1 billion years ago.) Oceans fill up; Domain Archaea (about 3.5 billion years ago.) Atmosphere of CO_2, H_2O, and N_2. UV light hitting Earth. Lots of volcanoes, clouds, and rain Bombardment by asteroids. Earth cooling. Earth and Solar System forming.	1000 3000 4500

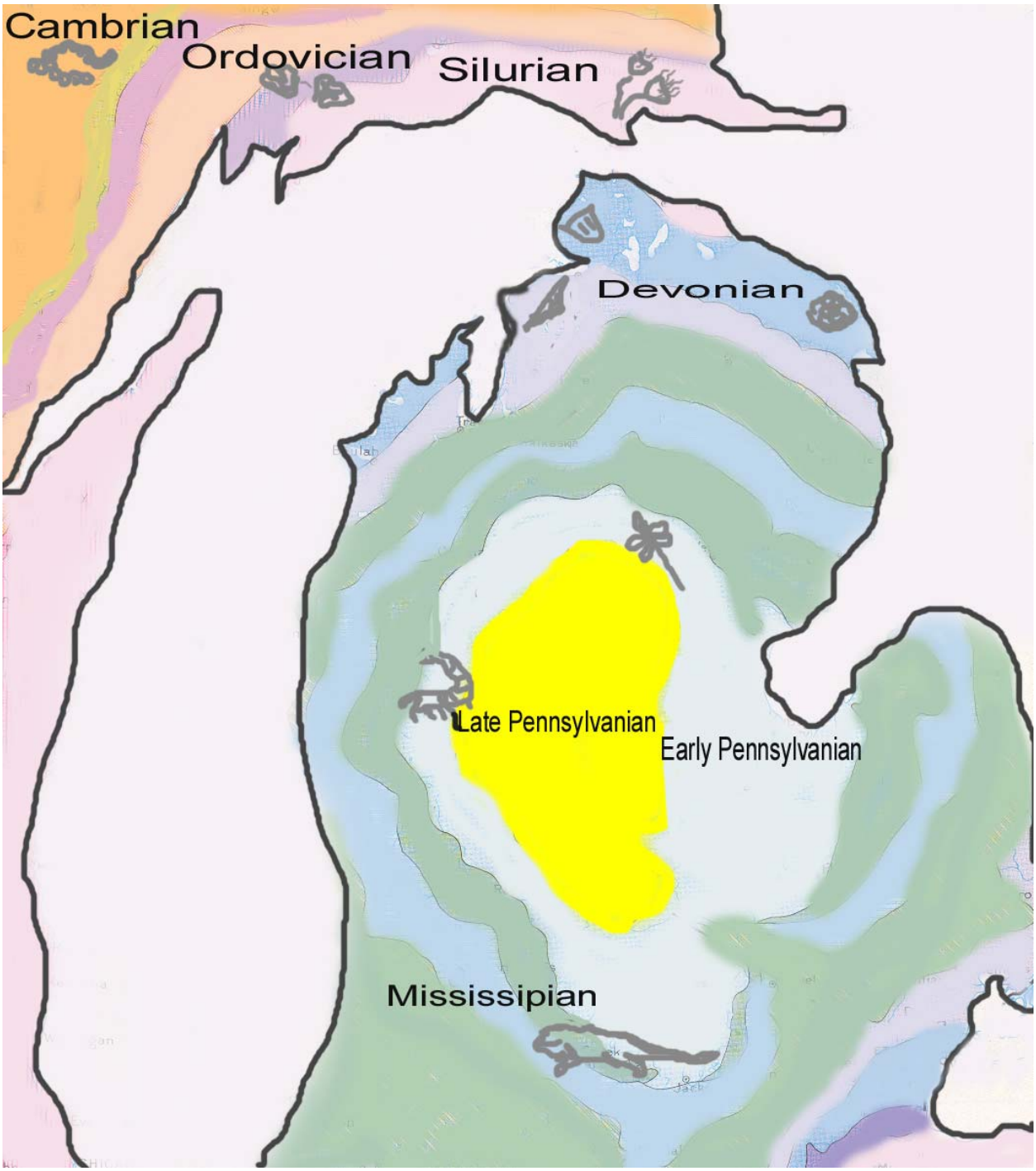
Mackinac Island shows evidence of several advances and retreats of the glaciers.



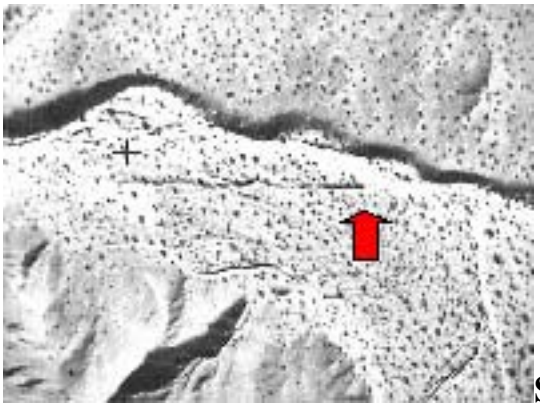
Source: USGS, 1945

Illustrations from Bulletin 4 - **The GLACIAL LAKES around MICHIGAN** - Page 16 of 16

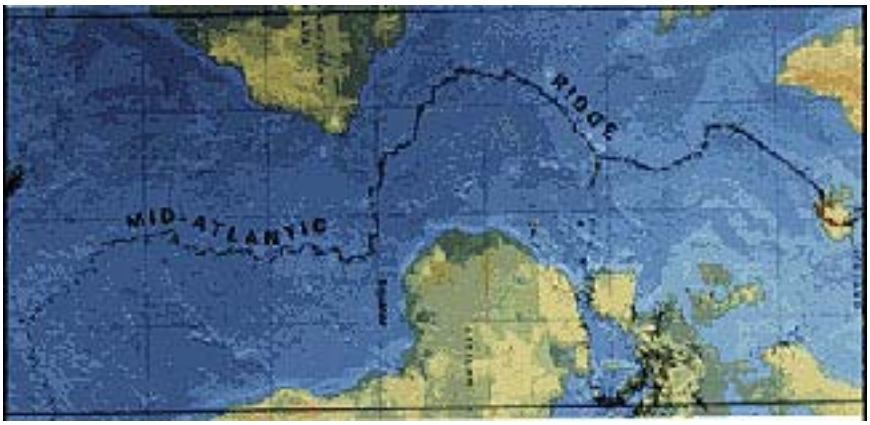
Alpena, Michigan Aerial showing glacial lakes (Long Lake and Grand Lake in the lower area; Hubbard Lake in upper right.)


Cambrian
Ordovician
Silurian
Devonian
Late Pennsylvanian
Early Pennsylvanian
Mississipian

Fossilized brain coral (upper left); Petoskey stone (lower left); brachiopods (lower right).



San Andreas Fault


RIDGE
MID-ATLANTIC