

Sea Level Changes through time

The types of rocks present in a location describe the environment at that location at a point in the past. Digging straight down shows how the climate and environment changed over time in that location. One of the biggest environmental factors determining which rocks are deposited is relative sea level.

This assignment shows a mildly modified section of the geologic record for the Black Hills area of South Dakota. These are the actual rock units that ISU geology students work with at Field Camp. The left side of the chart shows the time units, formation names, average thickness, and a description of the rocks in each formation.

The right side has an area for the sea level curve. A sea level curve shows where the edge of the ocean is relative to you at any given time. An arbitrary modern sea level has been designated by the dotted line running down the center. To help visualize the sea level curve, the words "Sea" and "Land" were added to the left and right sides, respectively. Any area on the left side of the curve you draw is under water, and any area to the right of the curve you draw is on land. Also for reference, at the top of the column four depositional environments have been indicated; stream, beach, shallow water, and deeper water. See the Powerpoint from lecture 9 for an example of a sea level curve.

When the rocks indicate erosion, for example, the land is exposed and sea level is very low. This is a regression; the sea has pulled back. Another way to visualize this is to think of a gauge. If the sea is low, there is more land, so a line or dot would be placed to divide the row into a big land chunk on the left and a smaller sea chunk on the right. You can place a dot somewhere on the far regression side of the chart for each of the erosion episodes.

By using what you learned in class, you can begin placing dots for the other formations based on the water depth needed for their deposition. When all the units have been given a relative sea level, connect the dots to complete your sea level curve. For the units that contain multiple rock types (i.e. sandstone, shale, and limestone all in one unit) you can use your artistic license to indicate all the necessary environments.

Sea Level Changes in the Geologic Record

				Regression	Modern Sea Level	Transgression		
				stream	beach	shallow water	deep water	
Early Mesozoic	Jurassic	Morrison Fm	100	Varigated mudstones and gray sandstones				
		Unkpapa Sandstone	265	White to bright yellow and red fine sandstone				
		Sundance Fm	350	Red and gray green shale, white to yellow sandstone and thin limestones.				
	208 Ma	Erosion Episode						
	Triassic	245 Ma	Spearfish Fm	800	Red beds mostly siltstone with gypsum layers at top and base.			
Paleozoic	Permian	Minnekahta Limestone	40	Pink to gray thinly bedded limestone.				
		Opeche Shale	130	Red siltstone and shale				
		286 Ma						
	Pennsylvanian	320 Ma	Minnelusa Fm	725	Yellow to red sandstone, shale, and limestone.			
	Erosion Episode							
	Mississippian	360 Ma	Pahasapa Limestone	600	Dolomitic massive limestone with caves in the upper part.			
			Englewood Limestone	50	Lower unit is shale and dark pink to buff limestone is upper unit.			
	Devonian	408 Ma	Major Erosion Episode					
	Silurian	438 Ma						
	Ordovician	505 Ma	Whitewood Fm	70	Light yellow dolomite and limestone.			
			Winnipeg Fm	70	Green shale and upper siltstone.			
	Cambrian	570 Ma	Deadwood Fm	400	Massive red brown to light yellow sandstone, and local conglomerates.			
	Erosion Episode							