

Map of Lawrence and vicinity ★ Locations of outcrops

So, the geologic history of the Lawrence area, although incomplete, gives us a picture of past events. Today is a time of erosion and the land is being denuded rapidly by wind and water as the unconsolidated material is blown or washed away. We need to be cognizant of our situation and preserve our heritage.



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# GEOLOGY of Lawrence, Kansas

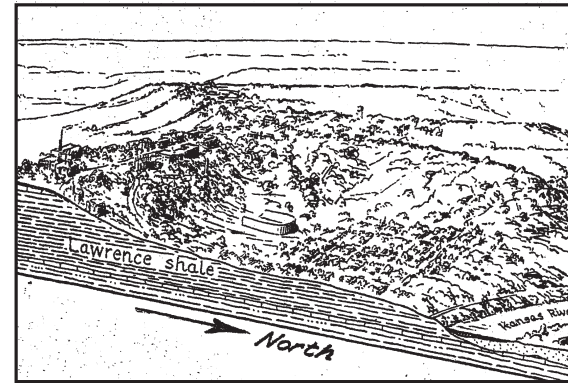


Kaw River Valley just east of Lawrence

Lawrence, Kansas, the namesake of Amos Lawrence of the New England Emigrant Aid Society of Massachusetts, a city of about one hundred thousand, home of The University of Kansas (KU) and Haskell Indian Nations University, is a thriving Midwestern city. Founded in 1854 in Kansas Territory (capitol just a few miles west at Lecompton), it suffered in Civil War days when Quantrill sacked and burned the city in 1863, but from the ashes came the city's motto, *From Ashes to Immortality*. The 'first skirmish' of the Civil War, as considered by some, was just to the south at Black Jack on Pottawattomie Creek 40 miles east of Baldwin City in 1856. Kansas was admitted to the Union as the 34th state in January of 1861 just at the start of the Civil War.

Lawrence is located in the rolling hills of eastern Kansas, a region known as Osage Cuesta country, and at the southern end of sediments left from the retreating glaciers. The picturesque city lies between the east-flowing Kansas (Kaw) River in the northern part of town and the Wakarusa River to the south, and they join at Eudora just a few miles east of Lawrence. The farmland in the river valleys is fertile and productive. On occasion, the two rivers flood as in 1844, 1903, 1927, 1951, and 1993..

Dominating the topography of the city is Mt. Oread, an east-facing scarp held up by the more resistant limestone. KU, built on Mt. Oread, dominates the skyline of the city. Many of the older buildings on campus were built of Oread Limestone quarried in place 'on the hill.' Some of these old quarries are visible in and near the city. Much of the geology in the city, however, is obscured by pavement, asphalt, landscaped yards, and housing.



Mt. Oread held up by the resistant limestone in the Oread Limestone

The Oread Limestone, named for Mt. Oread, consists of alternating hard limestone and softer shale and overlies the thick softer Lawrence Shale that contains sandstone lenses of ancient river systems. Rock units are named by geologists for place names where the unit was first noted or described and thus the names Oread Limestone and Lawrence Shale. The topography east of Lawrence is lower because the softer shale was eroded, except for outliers such as Blue Mound that is capped by the more resistant Oread limestone. Blue Mound once had a ski run on the north slope, but the lack of snow was its demise.

The Oread Limestone and Lawrence Shale of Pennsylvanian age were deposited in or adjacent to an ancient ocean - the Kansas Sea - some 295 million years ago. They contain fossil shells as evidence of their marine origin or plant material as evidence of a terrestrial environment. A close look at the marine rocks will reveal remains of crinoids, bryozoans, clams, and a small single celled animal termed a fusulinid. Fusulinids, shaped like a grain of wheat, lived in the ocean and were abundant in the warm waters of the Kansas Sea, which at the time was located near the Earth's equator.

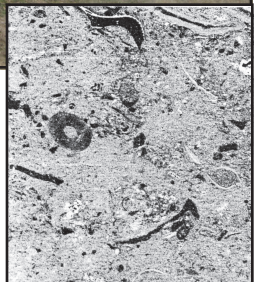
KANSAS GEOLOGICAL TIMETABLE  
(NOT SCALED FOR GEOLOGIC TIME OR THICKNESS OF DEPOSITS)

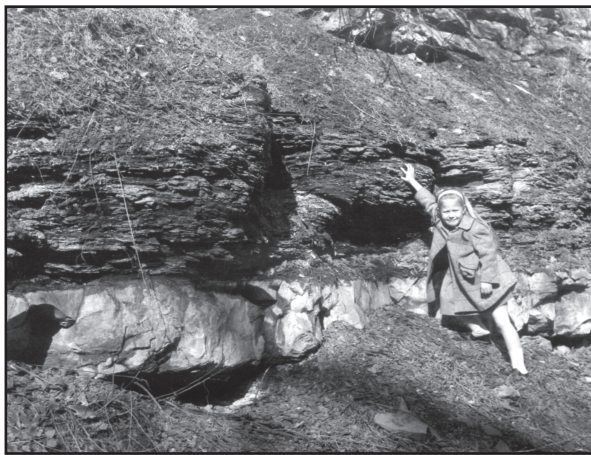
ERAS	PERIODS	EPOCHS	EST. LENGTH (YEARS)*	DESCRIPTION	MILLION YEARS PAST
CENOZOIC	QUATERNARY	HOLOCENE	10,000+	Mostly glacial debris in the northeastern part of the state left by retreating glaciers	1.8
		PLEISTOCENE	1,790,000		
	TERTIARY	PLIOCENE	3,500,000	Western Kansas is covered by these sediments many derived from the Rocky Mountains to the west.	
		MIOCENE	18,500,000		
		OLIGOCENE	9,900,000		
MESOZOIC	CRETACEOUS	7,000,000	Thick marine limestones, chalks and shales, covering the western one-half of the state.	65	
	JURASSIC	63,700,000	Non-marine rocks that occur only in the subsurface in western Kansas.	142	
PALEOZOIC	TRIASSIC	42,500,000	Small area in southwestern Kansas has the only outcrop of rocks this age.	205.7	
	PERMIAN	41,800,000	Sea deposited limestone with flint (chert), became briny, and then evaporated and weathering and erosion took over.	248.2	
	PENNSYLVANIAN	33,000,000	Repeated layers of limestone, shale, and sandstone indicating the rise and fall of sea level	290	
	MISSISSIPPIAN	31,000,000	Alternating layers of limestone, shale and sandstone; outcrop in extreme southeastern Kansas.	323	
	DEVONIAN	63,000,000	Seas covered Kansas again.	354	
SUBSURFACE ONLY	SILURIAN	26,000,000	Land was uplifted and eroded.	417	
	ORDOVICIAN	52,000,000	Seas covered Kansas for part of the time.	443	
	CAMBRIAN	50,000,000	First rocks with fossils deposited in an old sea.	495	
PRECAMBRIAN		4,055,000,000	Oldest rocks on Earth mostly igneous and metamorphic.	545	
					4600?

(modified from Kansas Geological Survey timetable)



Plattsmouth Limestone of the Oread Limestone at 6th and Rockledge; (inset) a thin section showing fossil shells in the limestone





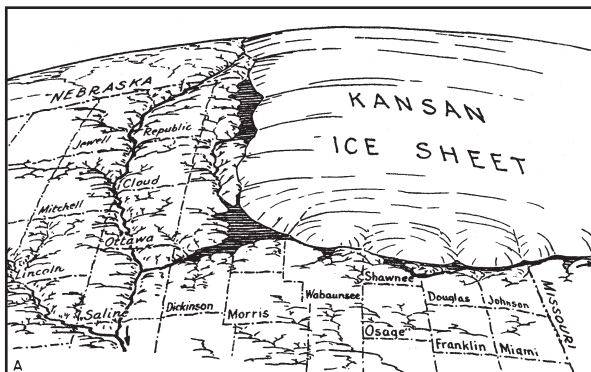
Leavenworth Limestone and overlying black Heebner Shale in Centennial Park

The sea came and went as sealevel rose or fell and as the Earth's crust was depressed the sediments accumulated in a sequence that geologists term a cyclothem. Cyclothem, or repetitions of rock types, give evidence of this rise and fall of sealevel as different types of sediments are deposited under different conditions and then hardened into rock. The Oread Limestone is a prime example of this natural phenomenon.

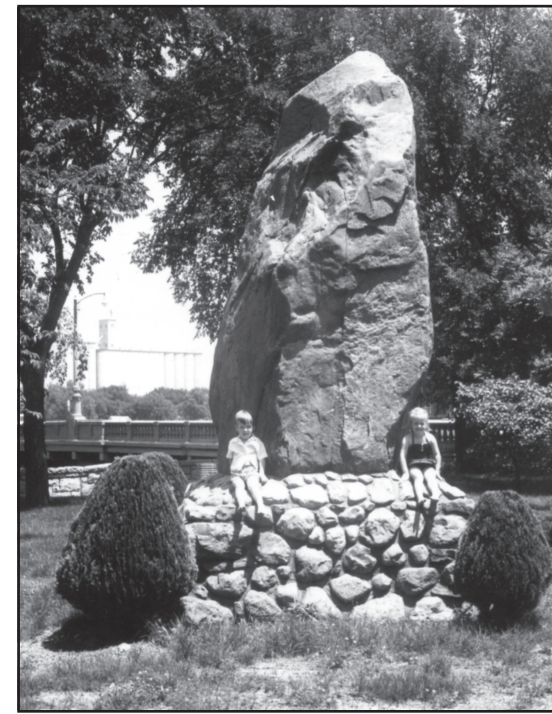


Sandstone in the Lawrence Shale at 29th and Haskell

Because the rock units are dipping (tipped) gently to the west, younger rocks are encountered toward Topeka and older ones to the east towards Kansas City. These Pennsylvanian-aged rocks dipping westward are encountered in the subsurface in central and western Kansas and locally produce oil and gas.



Recreation of the Kansan ice sheet that covered Lawrence about 600,000 years ago

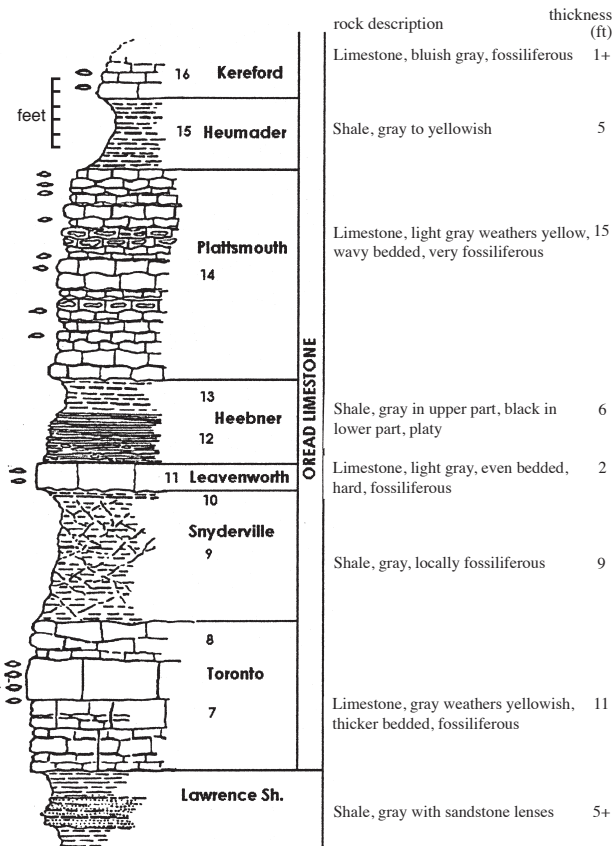


Sioux Quartzite erratic at 6th and Massachusetts

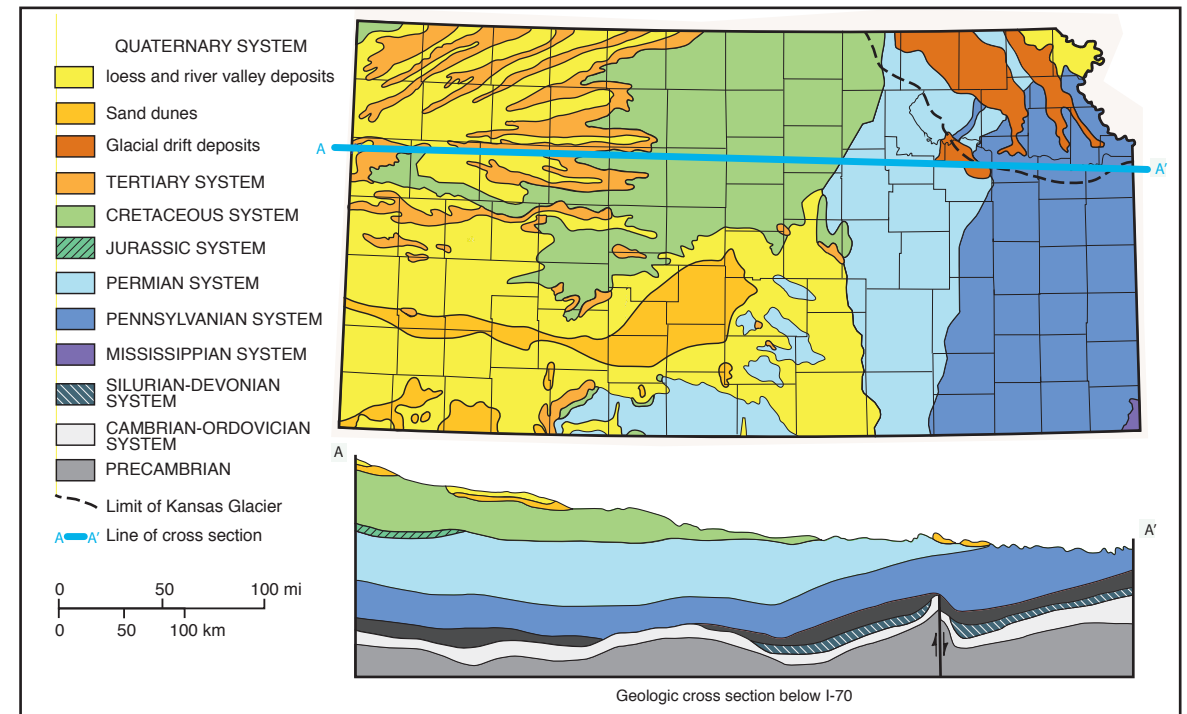
There is a long break in the geologic record until the next event - the earlier Nebraskan glacier followed by the Kansan glacier that covered northeastern Kansas about 600,000 years ago. Evidence of the present of these mighty glaciers are erratics (rocks out-of-place) and the glacial erratics are composed of igneous and metamorphic rocks brought from as far away as South Dakota, Minnesota, and Canada. Knowing where the erratics came from gives evidence of the direction of flow of the glaciers.

What is beneath the rocks on which the city is built? Wells drilled in Lawrence and vicinity gives an indication as to the rock units below. Although the rock record is incomplete, the rocks present tell us that earlier seas came in and out of the area as sealevel changed and the land was depressed

About 2,000 feet of these rock units give an incomplete but coherent story. The sedimentary rocks overlie the basement of old crystalline rocks that are part of the Earth's crust that is exposed farther north in Canada, and these rocks are approximately 1.3 billion years old. These ancient rocks form a stable platform on which subsequent events took place.



Graphic section of the Oread Limestone showing the alternation of rock types.  $\ominus$  fusulinid



Geologic map of Kansas (courtesy of the Kansas Geological Survey)