KANSAS GEOLOGICAL SURVEY

OPEN-FILE REPORT 1934-3

Pennsylvanian and "Permian" rocks of Kansas, composite section along Kansas River and in west-central Missouri

by

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Disclaimer

Kansas Geological Survey

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1934-3

PENNSYLVANIAN AND "PERMIAN" ROCKS OF KANSAS

COMPOSITE SECTION ALONG KANSAS RIVER AND IN WEST CENTRAL MISSOURI

By Raymond C. Moore assisted by Maxim K. Elias and Norman D. Newell

1934

Des Moines series

Bourbon formation — DISCONFORMITY

Vertical Scale 250 FT.

Nowata sh.(?) Allamont ls.(?)

Worland ls. — Bandera sh. — Marmaton group

Mulberry coal — Pawnee ls.

Lexington cap rock / Lexington coal — Labette sh.

Fort Scott ls.

Summit coal

Mulky coal

Bevier coal

Ardmore ls.

Tebo coal

Jordan coal

Cherokee shale

DISCONFORMITY

MISSISSIPPIAN

Missouri series

Fontana sh. (Kansas City group)

Winterset ls. — Dennis ls. — Bronson

Stark sh. — Canville ls. — Galesburg sh.

Bethany Falls ls. — Swope ls.

Hushpuckney sh. — Middle Creek ls. — Ladore sh. — Hertha ls.

Snlabar ls.

Bourbon formation

Warrensburg channel sandstone

Worland ls. — Pawnee ls. — Lexington Cap rock — Upper ft. Scott — Upper ls. — Lower ls. — Lower ft. Scott

DISCONFORMITY

Des Moines series

Explanation: A-algae, M-mollusks, F-fusulinids

Stranger fm. (Douglas group)

Iatan ls.

Weston sh. — Pedee

Little Kaw ls. — Victory Jct. sh. — Olathe ls. — Stanton ls.

Eudora sh. — Captain Cr. ls.

Vilas sh.

Spring Hill ls. — Hickory Cr. sh. — Merriam ls. — Plattsburg ls. — Lansing

Bonner Springs sh.

Farley ls. — Island Cr. sh. — Wyandotte ls.

Argentine ls.

Quindaro sh. — Frisbie ls. — Kansas City

Lane sh.

Raytown ls. — Muncie Cr. sh. — Iola ls.

Paola ls. — Chanute sh.

Corbin City ls. — Cement City ls. — Drum ls.

Quivira sh.

Westerville ls.

Wea sh.

Block ls.

Fontana sh.

Winterset ls.

Explanation: A-algae, B-brachiopods, F-fusulinids, M-mollusks

Oread ls. (Shawnee group)

COAL

Amazonia ls. — Lawrence sh.

Ireland ss. — Haskell ls.

Vinland sh.

COAL

Iatan ls. — Stranger fm.

Tonganoxie ss. — Douglas group

Weston sh.

Stanton ls.

DISCONFORMITY

Missouri series

Virgil series

Coal Creek ls.

Holt sh.

DuBois ls. — Deer Creek — Topeka

Turner Creek sh.

Hartford ls. — Hartford — Deer Cr. — Calhoun

Iowa Point sh.

Sheldon ls. — Sheldon — Tecumseh

Jones Point sh.

Ervine Creek ls. — Ervine Cr. — Lecompton

Larsh-Mission Creek sh.

Rock Bluff ls. — Oskaloosa sh. — Oskaloosa — Shawnee group

Ozawkie ls. — Ozawkie — Kanwaka

Rakers Creek sh.

Ost ls. — Ost — Oread

Kenosha sh.

Avoca ls. — Avoca

King Hill sh.

Bell ls. — Bell

Queen Hill sh.

Big Springs ls.

Doniphan sh.

Spring Branch ls. — Spring Branch

Stull sh. — Stull

Clay Creek ls. — Clay Creek

Jackson Park sh.

Kereford ls. — Kereford

Heumader sh.

Platsmouth ls. — Platsmouth (Unh.)

Plattsmouth ls.

Heebner sh.

Leavenworth ls.

Snyderville sh.

Toronto ls. — Toronto

Explanation - A-algae, M-mollusks, F-fusulinids

Big Blue series

Towle sh.- Big Blue series — DISCONFORMITY

Brownville ls. — Canyeville — Cyclothem Phase Fossils

Pony Creek sh.

Caneyville ls.

COAL-Canyon

French Creek sh.

Jim Creek ls. — Jim Cr.

Friedrich sh.

Grandhaven ls. — Godfrey

Dry sh. — Dover

Dover ls.

SYNTHETIC HORIZON

Table Creek sh. — Dover — Maple Hill

Maple Hill ls.

Pierson Point sh.

Tarkio ls. — Tarkio

Willard sh. — Elmont

Elmont ls.

Harveyville sh. — Reading ls. — Reading

Auburn sh. — Auburn

Wakarusa ls. — Wakarusa

Soldier Creek sh.

Burlingame ls. — Burlingame

Silver Lake sh. — Rulo

Rulo ls.

Cedar Vale sh.

Happy Hollow ls. — Happy Hollow

White Cloud sh.

Howard ls. — Howard

COAL-Nodaway

Severy sh. — Topeka

Top of Shawnee group

Explanation: A-algae, F-fusulinids M-mollusks

Wreford ls.- Chase group

Speiser sh. — Speiser — Wreford — Cyclothem Phase Fossils

Funston ls.

Blue Rapids sh. — Bigelow ls. — Bigelow

Crouse ls.

Easly Creek sh.

Middleburg ls. — Hooser sh. — Bader ls. — Bader

Eiss ls.

Stearns sh.

Morrill ls. — Florena sh. — Cottonwood ls. — Beattie ls. — Beattie

Eskridge sh. — Grenola

Neva ls. — Grenola ls. — Grenola

Salem Point sh.

Burr ls. — Red Eagle

Roca sh.

Howe ls. — Bennett sh. — Glenrock ls. — Red Eagle sh. — Red Eagle

Johnson sh. — Johnson

Long Creek ls.

Hughes Creek sh. — Foraker ls. — Foraker

Americus ls.

Oaks sh.

Houchen Creek ls. — Hamlin sh. — Five Point ls.

Stine sh.

West Branch sh.

Falls City ls. — Falls City

Hawxby sh.

Aspinwall ls. — Aspinwall — Admire

Brinville

Indian Cave ss. — Towle sh.

Jim Cr.

DISCONFORMITY

Wabaunsee group

PENNSYLVANIAN

Grandhaven

Dover

Explanation: A-algae, B-brachiopods, F-fusulinids, M-mollusks

Wellington sh. (upper part)

Carlton ls. — Buckeye sh. — Wellington sh. — Wellington — Cyclothem Phase Fossils

Strickler ls. — Newbern sh. — Hollenberg ls. — Donegal ls. — Donegal

Pearl sh. — Nolans

Herington ls. — Paddock sh. — Nolans ls. — Nolans

Krider ls.

Odell sh.

Luta ls. — Cresswell ls. — Grant sh. — Stovall ls. — Winfield ls. — Winfield

Gage sh.

Towanda ls. — Towanda

Holmesville sh.

Ft. Riley ls. — Oketo sh. — Florence ls. — Barneston ls. — Barneston

Blue Springs sh.

Kinney ls. — Kinney

Wymore sh.

Schroyer ls. — Havensville sh. — Wreford ls. — Wreford

Threemile ls.

Speiser sh.- Council Grove group

Chase — Council Grove — Sumner

Explanation: B-brachiopods, M-mollusks, L-Lingula

Index section

Scale — Formation — Group — Series

Wellington — Sumner

Donegal — Nolans — Winfield — Towanda — Barneston — Kinney — Wreford — Bigelow — Bader — Beattie — Red Eagle — Toraker — Grenola — Five Point — Falls City — Brownville — Dover — Tarkio — Elmont — Burlingame — Howard — Topeka — Deer Cr. — Lecompton — Oread — Haskell — Iatan — Stanton — Plattsburg — Wyandotte — Iola — Westerville — Dennis — Swope — Bethany Falls — Pawnee — Ft. Scott — Mississippian

Council Grove — Big Blue series — Admire — Wabaunsee — Virgil series — Shawnee — Douglas — Pedee — Lansing — Kansas City — Missouri series — Bronson — Bourbon — Marmaton — Des Moines series — Cherokee

Explanation of symbols

- Limestone cherty
- Limestone
- Shale, clayey
- Shale, sandy
- Shale, black, fissile
- Coal
- Red beds
- Sandstone

Ideal Cyclothem of the Kansas Pennsylvanian

Phases

9 Unfossiliferous, may have land plant remains
8 Mollusks, or unfossiliferous
7 Algae, mollusks, brachiopods, bryozoans
6 Brachiopods, bryozoans
5 Fusulinids dominant, may have brachiopods, bryozoans etc. Culminating marine phase
4 Brachiopods, bryozoans
3 Mollusks, brachiopods, bryozoans
2 Mollusks, especially *Myalina*
1c Coal — Underclay
1a Land plants, — May have land plant remains
0

Ideal Cyclothem of the Kansas "Permian"

Phases

1 Red shale / Green shale — No marine fossils
2 *Lingula* phase
3 Pelecypod phase
4 Pelecypod (*Allorisma, Pinna, Myalina*) and brachiopod phase
5 Brachiopod phase
6 Fusulinid phase
6 Brachiopod phase
5 Pelecypod (*Allorisma, Pinna, Myalina*) and brachiopod phase
4 Pelecypod phase
3 *Lingula* phase
2 Green shale / Red shale — No marine fossils
1

A cyclothem comprises the deposits of a sedimentary cycle.
A megacyclothem comprises two or more cyclothems of different characters that occur in regular sequence.

Rock Formations of Kansas

By RAYMOND C. MOORE, State Geologist
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The following tabulation of the rock formations of Kansas, prepared at request of the Kansas Geological Society, shows the present classification of stratigraphic units, in part tentative, that are recognized in the state, with brief description of lithologic characteristics. Figures representing average thickness are given in most cases, accompanied by indication of approximate maximum observed thickness (shown in parentheses). Space does not permit discussion of certain doubtful and tentative features shown in the table. Classification of the Dakota beds is especially in doubt, awaiting completion of studies by Dr. A. C. Tester.

Acknowledgments are due Drs. N. D. Newell and M. K. Elias for assistance in preparing parts of the table and to a committee of the Kansas Geological Society under chairmanship of Mr. Jas. I. Daniels for data on thicknesses of subsurface units.

System	Series	Group	Formation	Member	Thickness Feet	Lithologic Character and Special Notes
Quaternary	Recent		Alluvium		0-100±	Gravel, sand, silt and clay deposits of stream valleys. Includes some terrace materials.
			Dune sand, loess		0-50±	Sand and silt deposited by winds, chiefly in south-central and western Kansas.
			Unconformity			
	Pleistocene		Sanborn fm.		35 (180)	Sand and gravel overlain by loess, chiefly in western Kansas.
			Unconformity			
			Belleville fm.		60 (200)	Sand, gravel and clay, in north-central Kansas. May correspond in age to McPherson formation.
			Unconformity			
			McPherson fm.		100 (250)	Sand, gravel and clay, in west-central Kansas.
			Unconformity			
			Kansan drift		10 (60)	Glacial till. May be partly contemporaneous with McPherson formation.
			Unconformity			
Tertiary	Pliocene		Ogallala fm.		125 (210)	"Mortar beds" composed of sand and fine gravel cemented by calcium carbonate, clay. Includes algal limestone. Mammal bones, grass seeds.
			Unconformity			
	Oligocene?		Woodhouse clay		20 (60)	Bright-colored mottled clay, fragmentary mammal bones.
			Unconformity			
Cretaceous	Montana		Pierre sh.	Beecher Island sh.	100	Gray shale, limonite concretions.
				Undifferentiated	600	Black and gray shale.
				Salt Grass sh.	60	Gray shale, limestone and limonite concretions.
				Lake Creek sh.	200	Black and dark-gray flaky shale, gypsum locally abundant.
				Weskan sh.	170	Gray shale, large limestone concretions.
				Sharon Springs sh.	155	Black flaky shale, large septarian concretions.
					1250+	
			Niobrara chalk	Smoky Hill chalk	400 (700)	Alternating beds of soft chalk and chalky shale, with some thin bentonite beds.
				Hays ls.	60 (80)	Massive chalky limestone.
					750	
			Unconformity			
	Colorado		Carlile sh.	Codell ss.	10	Sandstone.
				Blue Hill sh.	200	Gray fissile shale with concretions in upper part.
				Fairport sh.	100	Chalky shale with thin limestones in lower part.
					300	
			Greenhorn ls.	Pfeifer sh.	20	Chalky shale with thin chalky limestones. Fencepost limestone bed at top. In Hamilton County where the Pfeifer and Jetmore members are not separable, they are combined under the term Bridge Creek shale member.
				Jetmore chalk	20	Chalky limestone and shale. "Shell limestone" at top.
				Hartland sh.	35 (50)	Bluish-gray chalky shale with a few thin limestones.
				Lincoln ls.	20	Hard crystalline limestone and chalky shale.
					75	
			Graneros sh.		40	Bluish-gray clay shale, sandy shale and lenses of shaly sandstone.
	Dakota		Solomon fm.	Sandstone Hodgeman sh.	15-100	Dark-gray and black shale and brown sandstone, mostly marine.
			Local Unconformity			
			Ellsworth fm.	Rocktown ss. Terra Cotta sh.	25-200	Yellow brown sandstone and reddish or vari-colored shale, mostly nonmarine.
			Local Unconformity			
			Belvidere fm.	Mentor ss. Marquette ss. Kiowa sh.	100-300	Light and dark brown sandstone, dark-gray and black shale and thin shelly limestone, mostly marine.
			Unconformity			
			Cheyenne ss.		50	Yellow-brown sandstone, nonmarine.
			Unconformity			
Permian	Cimarron		Greer fm.	Big Basin ss.	12	Massive red or gray sandstone.
				Shale	20	Maroon-colored shale.
			Woodward fm.	Day Creek dol.	4	Hard white dolomite.
				Whitehorse ss.	200	Fine-grained light-red sandstone and sandy shale.
				Dog Creek sh.	30 (44)	Dull-red clay shale with some thin dolomitic limestone beds.
					250	
			Cave Creek fm.	Shimer gyp.	5 (25)	Massive gypsum.
				Jenkins sh.	5 (50)	Red clay shale.
				Medicine Lodge gyp.	20 (27)	White to gray, massive gypsum.
					50	
			Enid fm.	Flowerpot sh.	175 (195)	Variegated gypsiferous clay shale.
				Cedar Hills ss.	250	Hard bright-red massive sandstone with inter-bedded red sandy shale.
				Harper ss.	700	Reddish-brown sandstone and sandy shale.
					1050	
			Unconformity			
	Sumner		Wellington sh	Shale and Ceuda salt	500±	Light-gray and red shale and salt beds.
				Carlton ls.	18	Light-gray flaggy limestone with pelecypods, insects and plant remains near base.
				Buckeye sh.	235	Gray shale with some thin red shale and gypsum.
					550+	
			Donegal ls.	Strickler ls.	2	White flaggy limestone, unfossiliferous.
				Newbern sh.	11	Gray calcareous shale.
				Hollenberg ls.	7	Brown flaggy limestone with good microfauna.
					20	
			Pearl sh.		27	Gray, green and red clay shale.
			Nolans ls.	Herington ls.	8	White to buff, massive and flaggy impure dolomitic limestone with dominantly molluscan fauna.
				Paddock sh.	14	Gray to olive drab clay shale.
				Krider ls.	6	White to gray limestone and calcareous shale, fossiliferous.
					28	
			Odell sh.		20	Olive drab, gray and maroon clay shale.
			Winfield ls.	Luta ls.	7	Light bluish-gray flaggy to platy earthy limestone.
				Cresswell ls.	9	Gray massive to thin-bedded chert-bearing limestone, echinoid remains generally common.
				Grant sh.	12	Light-gray clay shale with thin fossiliferous limestone beds near top.
				Stovall ls.	2	Dark-gray granular fossiliferous limestone, commonly chert-bearing.
					30	
			Gage sh.		40	Gray, green and red clay shale, with fossiliferous zone near top.
			Towanda ls.		11	Drab to greenish flaggy limestone with common gastropods.
			Holmesville sh.		20	Light-gray and red clay shale.
	Chase		Barneston ls.	Ft. Riley ls.	10	White to buff massive fossiliferous limestone.
				Oketo sh.	5	Light-gray calcareous shale.
				Florence ls.	25	Bluish-gray limestone with abundant nodules and beds of bluish dense chert.
					40	
			Blue Rapids sh.		28	Greenish and red, clay shale, locally with limestone bed near middle.
			Kinney ls.		11	Gray limestone and shale.
			Wymore sh		29	Olive-green, gray and red clay shale.
			Wreford ls.	Schroyer ls.	9	Gray cherty limestone.
				Havensville sh.	20	Olive and gray calcareous shale.
				Threemile ls.	11	Gray to bluish massive, chert-bearing limestone.
					40	
			Speiser sh.		17	Green, gray and red clay shale with local thin limy and sandy beds.
			Bigelow ls.	Funston ls.	5	Bluish-gray to buff massive limestone, gastropods common.
				Blue Rapids sh.	28	Gray, green and red clay and sandy shale.
				Crouse ls.	13	Gray massive limestone and calcareous shale, fossiliferous.
					46	
			Easly Creek sh.		15	Gray, green and red shale and gypsum.
			Rader ls.	Middleburg ls.	5	Dark-gray massive impure limestone with numerous small high-spired gastropods.
				Hooser sh.	8	Green, gray and red calcareous shale.
				Elss ls.	7	Bluish-gray limestone and shale, fossiliferous.
					20	
			Stearns sh.		18	Green and red shale, locally with platy beds.
			Beattie ls.	Morrill ls.	2	Dark-gray limestone, molluscan fauna.
				Florena sh.	9	Light-gray and olive calcareous shale, brachiopods and bryozoans abundant.
				Cottonwood ls.	6	Light-gray to buff massive limestone with abundant fusulinids, locally nodules of chert.
					17	
			Eskridge sh.		33	Light-green and red clay shale, containing some thin impure limestone beds.
			Grenola ls.	Neva ls.	18	Light-gray to white, massive to flaggy limestone.
				Salem Ft. sh.	7	Dark-gray hard calcareous shale.
				Burr ls.	8	Gray to buff, impure limestone, with molluscan fauna.
					33	
			Roca sh.		21	Green, gray and red clay shale.
			Red Eagle ls.	Howe ls.	1	Buff very impure unfossiliferous limestone.
				Bennett sh.	8	Dark-gray to black, fossiliferous clay shale.
				Glenrock ls.	5	Gray, massive limestone with abundant fusulinids.
					14	
			Johnson sh.		15	Gray, green and red shale, unfossiliferous.
			Foraker ls.	Long Creek ls.	5	Buff massive to thin-bedded limestone, few fossils.
				Hughes Creek sh.	39	Light-gray calcareous shale and thin limestone with extremely abundant fusulinids, brachiopods and bryozoans.
				Americus ls.	5	Gray limestone and black clay shale, fusulinids common.
					49	
			Oaks sh.		21	Gray, green and red shale.
			Hamlin sh.	Houchen Ck. ls.	1	Gray "mammillary" algal limestone.
				Stine sh.	23	Green, gray and red shale, unfossiliferous.
					45	
			Five Point ls.		4	Gray massive to flaggy limestone, fossiliferous.
			West Branch sh.		29	Gray, greenish and red shale, unfossiliferous.
			Falls City ls.		6	Gray to buff massive limestone and shale, upper part oolitic, porous.
			Hawxby sh.		13	Dark-gray shale with thin limestones, pelecypods abundant.
			Aspinwall ls.		4	Light-gray and buff fine-grained limestone, locally fossiliferous.
			Towle sh.	Shale	16	Green and red clayey and sandy shale.
				Indian Cave ss.	0-120	Light-brown massive and cross-bedded sandstone, lenses of conglomerate locally near base.
					15-135	
			Unconformity			
			Brownville ls.		2-4	Gray massive limestone weathering brown. Fossils common, especially *Marginifera*.
			Pony Creek sh.		15 (25)	Dark-gray and yellowish shale.
			Caneyville ls.		15 (35)	Gray limestone and shale. The Grayhorse limestone occurs at top and Nebraska City limestone at base.
			French Creek sh.		30 (42)	Gray and brownish clayey and sandy shale, with sandstone and Lorton coal in many places near top.
			Jim Creek ls.		1 (2)	Bluish-gray limestone weathering slightly red.
			Friedrich sh.		35 (45)	Gray and yellowish brown clayey and sandy shale, locally with sandstone.
			Grandhaven ls.		12 (20)	Light-gray limestone and shale, large fusulinids abundant in some beds.
			Dry sh.		5 (15)	Gray shale.
			Dover ls.		10 (24)	Gray to buff limestone, large fusulinids common in some beds.
			Table Creek sh.		12 (57)	Gray and brownish shale, in places with prominent sandstone in upper part.
			Maple Hill ls.		2	Dark-gray massive limestone, locally with abundant small fusulinids.
			Pierson Pt. sh.		14 (24)	Dark-gray shale, locally sandy and with coal bed near top.
			Tarkio ls.		4 (10)	Blue-gray to brown massive limestone with abundant large fusulinids.
			Willard sh.		30 (46)	Gray and brownish clayey and sandy shale, locally with sandstone at top.
			Elmont ls.		2 (19)	Dark-blue limestone and shale, in part with common fusulinids (formerly called upper Emporia).
			Harveyville sh.		8 (17)	Gray shale, locally with platy sandstone near middle.
			Reading ls.		3 (15)	Dark-blue dense hard limestone, fusulinids common (formerly called lower Emporia).
			Auburn sh.		36 (50)	Bluish-gray and yellowish shale, with thin persistent limestone and local sandstone beds.
			Wakarusa ls.		5 (13)	Dark bluish-gray massive limestone with large fusulinids and other fossils.
			Soldier Creek sh.		5 (26)	Gray and yellowish clay shale.

System	Series	Group	Formation	Member	Thickness Feet	Lithologic Character and Special Notes
Pennsylvanian	Virgil	Wabaunsee	Burlingame ls.		6 (16)	Gray to brown massive, in part pseudo-brecciated limestone, *Osagia* common.
			Silver Lake sh.		32 (44)	Gray and brownish shale, locally sandy.
			Rulo ls.		2	Dark-gray massive to shelly limestone, fairly fossiliferous.
			Cedar Vale sh.		22 (38)	Gray shale, clayey to sandy, with persistent Elmo coal and local sandstone near top.
			Happy Hollow ls.		3 (14)	Gray to salmon-colored massive limestone with abundant robust fusulinids.
			White Cloud sh.		60 (75)	Bluish-gray and brownish shale, locally with sandstone.
			Howard ls.		13 (20)	Dark to light-gray limestone and shale, in part contains persistent Nodaway coal. An important stratigraphic unit.
			Severy sh.		65 (75)	Gray and brownish sandy shale with persistent platy even-bedded sandstone near top.
			Topeka ls.	Coal Creek ls.	4 (5)	Dark bluish thin-bedded fine-grained limestone and shale, very fossiliferous.
				Holt sh.	2 (4)	Dark-gray to black clay shale.
				Du Bois ls.	1	Bluish-gray massive fine-grained limestone with molluscan fauna.
				Turner Creek sh.	1.5 (3)	Gray clay shale.
				Hartford ls.	7 (20)	Blue gray massive limestone, weathering brown, separated by shale beds. The Sheldon limestone of Condra is an algal-mollusean bed believed to belong at the top of this member.
					30	
				Jones Point sh.	5 (15)	Bluish-gray clayey and calcareous shale, locally with abundant mollusks and also containing land plants.
				Dashner ls.	5 (11)	Blue-gray and brown limestone and thin shale, fusulinid-bearing in part.
			Calhoun sh.		30 (50)	Gray and yellowish brown, clayey, calcareous and sandy shale, very fossiliferous in places.
			Deer Creek ls.	Ervine Ck. ls.	20 (32)	Light to dark-gray, thin and wavy-bedded fine-grained limestone, fusulinids common, except at top.
				Larsh-Mission Ck. sh.	4 (8)	Gray shale in upper part, black fissile shale in lower part. The Haynies limestone appears here to north.
				Rock Bluff ls.	1.5 (2.5)	Dark bluish-gray dense fine-grained massive limestone with vertical joints, fusulinids.
				Oskaloosa sh.	6 (10)	Gray shale.
				Ozawkie ls.	5 (30)	Gray to brown massive limestone beds separated in places by shale, fusulinids and algal remains common.
					35	
			Tecumseh sh.		36 (58)	Gray and yellowish-brown clayey and sandy shale. Locally contains sandy impure Ost limestone.
	Shawnee	Wabaunsee	Avoca ls.		1.5 (4)	Dark bluish-gray limestone, fusulinids common.
			King Hill sh.		5 (8)	Gray clay shale.
			Bell ls.		8 (16)	Blue gray limestone weathering yellow-brown, common fusulinids, brachipods and corals; algal bed at top.
			Lecompton ls.	Queen Hill sh.	3 (4)	Gray shale grading down into black fissile shale.
				Big Springs ls.	2 (6)	Blue-gray dense massive fine-grained limestone with vertical joints, fusulinids abundant.
				Doniphan sh.	3 (10)	Bluish-gray clay shale.
				Spring Branch ls.	6 (12)	Gray massive limestone weathering brown, and shale, contain algal beds at top.
					29	
			Stull sh.		24 (42)	Gray and brownish clayey and sandy shale, locally with sandstone near top.
			Kanwaka sh.	Clay Creek ls.	2	Bluish-gray massive to shelly limestone, fusulinids common.
				Jackson Park sh.	50 (80)	Gray and brown clayey and sandy shale with prominent sandstone beds and some red shale toward south.
					75	
			Lawrence sh.	Kereford ls.	4 (8)	Dark-gray, fine-grained or oolitic, massive to slabby limestone, in part with fusulinids and in part with molluscan fauna.
				Heumader sh.	3 (5)	Dark-gray clay shale.
				Plattsmouth ls.	18 (27)	Bluish-gray, fine-grained, thin and wavy-bedded limestone, fossiliferous, chert-bearing in part.
				Heebner sh.	5 (7)	Gray clay shale in upper part, black hard fissile shale in lower part.
				Leavenworth ls.	2	Dark-blue fine-grained dense limestone with vertical joints.
				Snyderville sh.	12 (70)	Gray underclay in most of north, includes thin sandstone, limestone and red shale toward south.
				Toronto ls.	8 (10)	Gray massive limestone weathering brown, fusulinids common locally.
					50	
			Local Unconformity			
			Haskell sh.		140 (200)	Gray and buff argillaceous to silty shales, sandstone beds, especially in the south, persistent coal near top (Williamsburg). Includes Ireland channel as 0-50 feet.
			Stranger fm.	Vinland sh.	2 (4)	Blocky, even, gray limestone, locally oolitic.
				Tonganoxie ss.	8 (14)	Argillaceous to silty shale.
					50 (80)	Massive, cross-bedded sandstone, coal beds, sandy shale, persistent coal (Sibley) at top.
					80 (100)	
	Douglas		*Unconformity*			
			Lecompton ls.		9 (18)	Thin-bedded, drab, sparsely fossiliferous limestone, weathers in a single massive ledge.
			Weston sh.		75 (140)	Bluish-gray to buff clay shale with limonite concretions. Fossiliferous in the north.
	Lansing	Douglas	Stanton ls.	Little Kaw ls.	2 (8)	Blocky, bluish, sandy limestone.
				Victory Junction sh.	2 (14)	Sandy gray shale; buff sandstone.
				Olathe ls.	15 (50)	Thin-bedded, wavy limestone, white to light-gray.
				Eudora sh.	5 (50)	Gray clay shale, commonly with black fissile layer near middle.
				Captain Creek ls.	8 (40)	Gray even limestone, becomes massive, crysalline, and white toward south.
					35 (140+)	
			Vilas sh.		20 (100)	Gray, silty to argillaceous shale.
			Plattsburg ls.	Springhill ls.	14 (60)	Drab to yellowish granular limestone with fine gray limestone below.
				Hickory Creek sh.	1 (40)	Limy gray or yellowish shale.
				Merriam ls.	1 (3)	Blocky gray to buff limestone.
					25 (100)	
			Bonner Springs sh.		15 (30)	Silty gray shale with maroon clay layer near top.
			Farley ls.		15 (35)	Variable limestone light-gray crystalline or drab, oolitic and cross-bedded in the north with consipicuous gray shale at middle.
			Wyandotte ls.	Island Creek sh.	2 (40)	Gray clay shale; thickest near Missouri river.
				Argentine ls.	20 (28)	Thin-bedded, wavy, light-gray to buff limestone.
				Quindaro sh.	1 (5)	Gray or yellowish shale, locally with carbonaceous layer.
				Frisbie ls.	2 (3)	Blocky, dense, bluish limestone, locally undifferentiated from Argentine.
					25 (60)	
			Lane sh.		35 (100)	Gray sandy or clayey shale.
			Iola ls.	Raytown ls.	4 (35)	Bluish-gray, even limestone, where thick becomes crystalline and light-gray or white.
				Muncie Creek sh.	1 (3)	Gray clay shale; around Kansas City with black fissile layer.
				Paola ls.	1.5	Bluish, dense limestone, blocky.
					12 (40)	
			Chanute sh.		25 (60)	Gray silty shale, with coal near middle (Thayer) and massive sandstone occupying upper half (Cottage Grove).
			Drum ls.	Corbin City ls.	0.5 (60)	Granular or oolitic drab limestone. Prominent only around Independence, Kansas.
				Cement City ls.	7 (9)	Thin-bedded, wavy, fine-grained white limestone.
					8 (60)	
			Quivira sh.		4 (8)	Gray to greenish clay shale with black fissile layer at middle.
			Westerville ls.		6 (10)	Gray limestone, upper part oolitic or cherty, lower part blocky gray fissile layer.
			Wea sh.		5 (10)	Limy or silty buff shale.
			Block ls.		3 (6)	Bluish, thin-bedded, fine-grained limestone with shaly partings.
			Fontana sh.		5 (35)	Gray clay shale.
			Dennis ls.	Winterset ls.	25 (35)	Dove-gray to light-gray cherty limestone, upper part oolitic or with black chert in northeastern Kansas.
				Stark sh.	5	Gray shale with black fissile layer.
				Canville ls.	2	Blocky, dense, bluish limestone.
			Galesburg sh.		25 (125)	Silty gray shale; in southern Kansas where thickest contains upper massive sandstone (Dodds Cr.) and persistent coal (Cedar Bluff) at middle.
			Swope ls.	Bethany Falls ls.	15 (25)	Variable limestone, upper part generally massive mottled algal limestone or oolite, lower part even gray limestone.
				Hushpuckney sh.	6	Gray shale with black fissile layer.
				Middle Creek ls.	2	Blocky, dense, blue limestone.
			Ladore sh.		8 (75±)	Gray silty shale, some heavy sandstone in the south where thickest.
			Hertha ls.		4 (10)	Variable buff heavy-bedded limestone with an upper phase of brecciated algal limestone (Schubert Creek?) and a more constant crystalline or fine-grained lower division (Snabar).
			Bourbon formation		150±	Undifferentiated shaly beds containing sandy lenses, local limestone, black shale, and channel sandstones at the base (Warrensburg).
			Unconformity			
			Unnamed sh.		?	
			Lenapah ls.		2 (20)	Gray variable limestone, possibly coalesces northward with the Altamont.
			Nowata sh.		20 (45)	Gray silty and argillaceous shale.
			Altamont ls.		10 (15)	Gray crystalline irregular limestone.
			Bandera sh.		60 (100+)	Sandy shale, flaggy sandstone, prominent limestone in the north (Worland) occurs near middle? Mulberry coal in lower part.
			Pawnee ls.		10 (50)	Ferruginous massive limestone.
			Labette sh.		20 (75)	Gray sandy and argillaceous shale.
			Fort Scott ls.	Upper ls.	10 (18)	Wavy-bedded crystalline white to light-gray limestone.
				Middle sh.	7	Gray clay shale with black fissile layer.
				Lower ls.	5 (18)	Drab, massive, magnesian limestone.
					30±	
			Cherokee sh.	Upper shale	75±	Silty and sandy gray to buff shale with coal (Mulky) overlain by black shale at top and coal (Bevier) near base.
				Ardmore ls.	2±	Blocky, bluish-gray, fine-grained limestone.
				Lower shale	350±	Heterogeneous shales with at least seven coal horizons, each underlying black fissile shales which are in turn locally capped by a limy layer.
			Unconformity			
				Sandstone	30±	Massive, cross-bedded brown sandstone.
Mississippian	Chester		"Mississippi lime"		Max. 1,125 ft. in Watchorn's Morrison No. 2, C NW NW sec. 20, T. 32 S., R. 21 W. (Dodge City Basin).	Blue-gray limestone and shale, local thin deposits filling sinks and depressions as in Jopin district and several hundred feet in the Dodge City basin. May include some Morrow beds in this area. Unconf. at base.
					Absent along Nemaha granite ridge and other major uplifts.	
			Unconformity			
	Valmeyer		"Chattanooga sh."		Max. 260 ft. in Voshell pool, T. 21 S., R. 3 W.	Light-gray fine to coarse-grained limestone with abundant chert (Boone), underlain in places by bluish to brownish cherty limestone and greenish-blue or in part reddish shale (Fern Glen). Average ±400 ft.
					Absent along major uplifts.	Shale gray and bluish with local thin limestone beds (Cheuteau-Hannibal).
	Kinderhook		*Unconformity*			Shale mostly black fissile, (Chattanooga), in places with sand (Misener) at base.
			"Hunton lime"		544 ft. in Hay No. 1, sec. 30, T. 6 S., R. 6 E. Absent on major uplifts.	White, gray, bluish and brown limestone and dolomite, in part cherty. A little shale and some sandstone commonly present.
			Unconformity			
Silurian	Devonian		"Maquoketa sh."		125 ft. in Johnson No. 1, sec. 30, T. 18 S., R. 2 W. Absent on major uplifts.	Dark-gray or greenish soft clay shale.
			Unconformity			
Ordovician	Mohawkan	Cincinnatian	"Viola lime"		185 ft. in Morrison No. 2, sec. 20, T. 32 S., R. 21 W. Absent on major uplifts.	Gray to brown dolomite, coarsely crystalline and fine-grained limestone, in part cherty.
			Unconformity			
		Champlainian	Simpson		203 ft. in Williams No. 1, SW NE SW, sec. 16, T. 35 S., R. 3 W. Absent on major uplifts.	Light-colored coarse sandstone and thin beds of green shale, limestone and dolomite.
			Unconformity			
Cambro-Ord.	Canadian	Ozarkian	"Arbuckle lime"		990 ft. in Eckhard No. 1, Sec. 9, T. 35, S., R. 6 E. Absent on high parts of Central Kansas and Nemaha uplifts.	Light-gray, white and buff crystalline dolomite, chert and some sandstone. Commonly called "Siliceous lime."
		Prairie du Chien	*Unconformity*			
Pre-Cambrian			"Granite"			Pink granite, dark schist and other types of crystalline rocks.

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1934

Des Moines series

Bourbon formation — DISCONFORMITY
- Nowata sh. (?)
- Altamont ls. (?)
- Worland ls. — Bandera sh.
- Mulberry coal
- Pawnee ls.
- Lexington cyprock / Lexington coal — Labette sh.
- Summit coal — Fort Scott ls. — Marmaton group
- Mulky coal
- Bevier coal
- Ardmore ls.
- Tebo coal
- Jordan coal
- Cherokee shale

DISCONFORMITY

MISSISSIPPIAN

Vertical Scale 250 FT.

Missouri series

Fontana sh. (Kansas City group)
- Winterset ls. — Dennis ls.
- Stark sh.
- Canville ls. — Galesburg sh.
- Bethany Falls ls. — Swope ls.
- Hushpuckney sh.
- Middle Creek ls. — Ladore sh.
- Ohiabar ls. — Hertha ls. — Bronson
- Bourbon formation
- Warrensburg channel sandstone
- Worland ls.
- Pawnee ls.
- Lexington Cyprock
- Upper ls.
- Lower ls.
- Lower Ft Scott

DISCONFORMITY

Des Moines series

Explanation: A algae, M mollusks, F fusulinids

Stranger fm. (Douglas group)
- Iatan ls.
- Weston sh. — Pedee
- Little Kaw ls.
- Victory Jct. sh.
- Olathe ls.
- Ludora sh.
- Captain Cr. ls. — Stanton ls.
- Vilas sh.
- Spring Hill ls.
- Hickory Cr. sh.
- Merriam ls. — Plattsburg ls.
- Bonner Springs sh.
- Farley ls.
- Island Cr. sh.
- Argentine ls. — Wyandotte ls.
- Quindaro sh.
- Frisbie ls. — Kansas City — Lansing
- Lane sh.
- Raytown ls.
- Muncie Cr. sh.
- Paola ls. — Iola ls.
- Chanute sh.
- Corbin City ls.
- Cement City ls. — Drum ls.
- Quivira sh.
- Westerville ls.
- Wea sh.
- Block ls.
- Fontana sh.

Winterset ls.

Explanation: A algae, B brachiopods, F fusulinids, M mollusks

Virgil series

Oread ls. (Shawnee group)
- Amazonia ls.
- Lawrence sh.
- Ireland ss.
- Haskell ls.
- Vinland sh.
- Iatan ls.
- Stranger fm.
- Tonganoxie ss.
- Weston sh.
- Stanton ls.

DISCONFORMITY

Missouri series

Douglas group

Deer Creek — Topeka — Calhoun — Deer Cr. — Topeka
- Loal Creek ls.
- Holt sh.
- DuBois ls.
- Turner Creek sh.
- Hartford ls.
- Iowa Point sh.
- Sheldon ls.
- Jones Point sh.
- Ervine Creek ls.
- Larsh Mission Creek sh.
- Rock Bluff ls.
- Oskaloosa sh.
- Grayskie ls.
- Lakes Creek sh.
- Ost ls.
- Kenosha sh.
- Avoca ls.
- King Hill sh.
- Beil ls.
- Queen Hill sh.
- Big Springs ls.
- Doniphan sh.
- Spring Branch ls.
- Stull sh.
- Clay Creek ls.
- Jackson Park sh.
- Kereford ls.
- Heumader sh.
- Plattsmouth ls.
- Heebner sh.
- Leavenworth ls.
- Snyderville sh.
- Toronto ls.

Lecompton — Tecumseh — Shawnee group

Oread — Kanwake — Oread

Toronto Linn Patsonville Nereford — Clay Creek — Spring Branch — Beil — Avoca — Ost — Sheldon — Hartford — Idlc — Megacyclothem — Cyclothem — Phase — Fossils

Explanation: A algae, M mollusks, F fusulinids

Big Blue series

Towle sh. Big Blue series — DISCONFORMITY
- Brownville ls.
- Pony Creek sh.
- Caneyville ls.
- French Creek sh.
- Jim Creek ls.
- Friedrich sh.
- Grandhaven ls.
- Dry sh.
- Dover ls.
- Table Creek sh.
- Maple Hill ls.
- Pierson Point sh.
- Tarkio ls.
- Willard sh.
- Elmont ls.
- Harveyville sh.
- Reading ls.
- Auburn sh.
- Wakarusa ls.
- Soldier Creek sh.
- Burlingame ls.
- Silver Lake sh.
- Rulo ls.
- Cedar Vale sh.
- Happy Hollow ls.
- White Cloud sh.
- Howard ls.
- Severy sh.

Top of Shawnee group

Wabaunsee group — Admire

Explanation: A algae, F fusulinids, M mollusks

Wreford ls. — Chase group
- Spencer sh.
- Funston ls.
- Blue Rapids sh. — Bigelow ls.
- Crouse ls.
- Easly Creek sh.
- Middleburg ls.
- Hooser sh. — Bader ls.
- Eiss ls.
- Shearns sh.
- Morrill ls.
- Florena sh. — Beattie ls.
- Cottonwood ls.
- Eskridge sh.
- Neva ls.
- Salem Point sh. — Grenola ls.
- Burr ls.
- Roca sh.
- Howe ls.
- Bennett sh. — Red Eagle ls.
- Glenrock ls.
- Johnson sh.
- Long Creek ls.
- Hughes Creek sh. — Foraker ls.
- Americus ls.
- Oaks sh.
- Houchen Creek ls. — Hamlin sh.
- Stine sh.
- Five Point ls.
- West Branch sh.
- Falls City ls.
- Hawxby sh.
- Aspinwall ls.
- Towle sh.

DISCONFORMITY

Wabaunsee group

PENNSYLVANIAN

Explanation: A algae B brachiopods, F fusulinids, M mollusks

Wellington sh. (upper part)
- Carlton ls.
- Buckeye sh. — Wellington sh.
- Strickler ls.
- Newbern sh. — Donegal ls.
- Hollenberg ls.
- Pearl sh.
- Herington ls.
- Paddock sh. — Nolans ls.
- Krider ls.
- Odell sh. — Sumner
- Luta ls.
- Cresswell ls. — Winfield ls.
- Grant sh.
- Stovall ls.
- Gage sh.
- Towanda ls.
- Holmesville sh.
- Ft. Riley ls.
- Oketo sh.
- Florence ls. — Barneston ls.
- Blue Springs sh.
- Kinney ls.
- Wymore sh.
- Schroyer ls.
- Havensville sh. — Wreford ls.
- Threemile ls.

Speiser sh. — Council Grove group

Explanation: B brachiopods, M mollusks, L Lingula

Cyclothem — Phase — Fossils — Formation — Group — Series

Index section

Scale (ft.)

Wellington — Donegal — Nolans — Winfield — Towanda — Barneston — Kinney — Wreford — Bigelow — Bader — Beattie — Grenola — Red Eagle — Foraker — Five Point — Falls City — Brownville — Dover — Tarkio — Elmont — Harveyville — Howard — Topeka — Inner Cr. — Lecompton — Oread — Haskell — Iatan — Stanton — Plattsburg — Wyandotte — Iola — Bethany Falls — Dennis — Swope — Pawnee — Ft Scott

Sumner — Chase — Council Grove — Admire — Wabaunsee — Shawnee — Douglas — Pedee — Lansing — Kansas City — Bronson — Marmaton — Cherokee

Big Blue series — Virgil series — Missouri series — Des Moines series

Mississippian

Explanation of symbols

- Limestone, cherty
- Limestone
- Shale, clayey
- Shale, sandy
- Shale, black, fissile
- Coal
- Red beds
- Sandstone

Ideal Cyclothem of the Kansas Pennsylvanian

Phases

9		Unfossiliferous, may have land plant remains
8		Mollusks, or unfossiliferous
7		Algae, mollusks, brachiopods, bryozoans
6		Brachiopods, bryozoans
5		Fusulinids dominant, may have brachiopods, bryozoans etc. Culminating marine phase
4		Brachiopods, bryozoans
3		Mollusks, brachiopods, bryozoans
2		Mollusks, especially *Myalina*
1		Coal, Underclay
0		Land plants,
		May have land plant remains

Ideal Cyclothem of the Kansas "Permian"

Phases

1	Red shale	No marine fossils
2	Green shale	
3	*Lingula* phase	
4	Pelecypod phase	
5	Pelecypod (*Allorisma, Pinna, Myalina*) and brachiopod phase	
6	Brachiopod phase	
7	Fusulinid phase	
8	Brachiopod phase	
5	Pelecypod (*Allorisma, Pinna, Myalina*) and brachiopod phase	
4	Pelecypod phase	
3	*Lingula* phase	
2	Green shale	
1	Red shale	No marine fossils

A cyclothem comprises the deposits of a sedimentary cycle.

A megacyclothem comprises two or more cyclothems of different characters that occur in regular sequence.

KGS OF 34-3

OF 34-3

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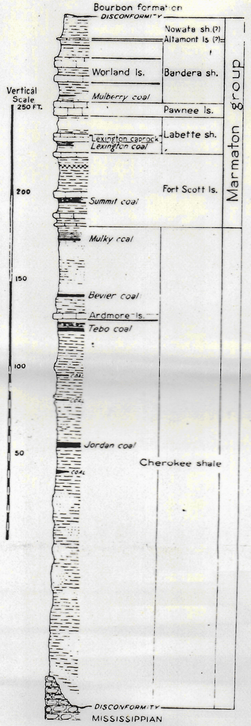
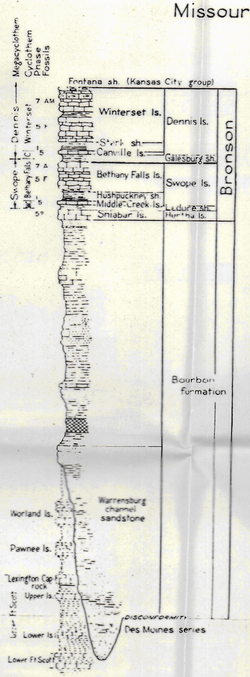
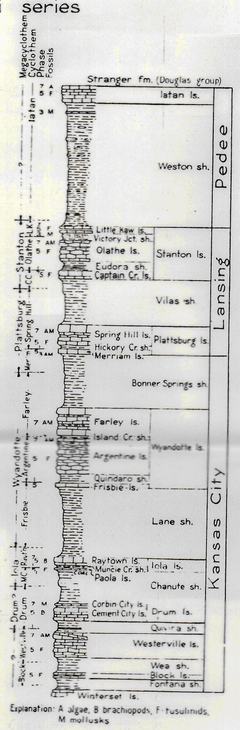
1934

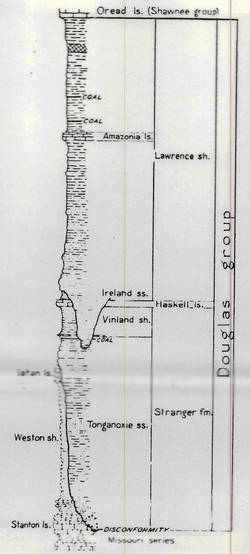
Des Moines series



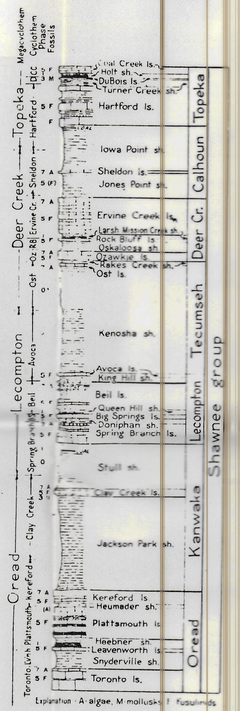
Missouri series



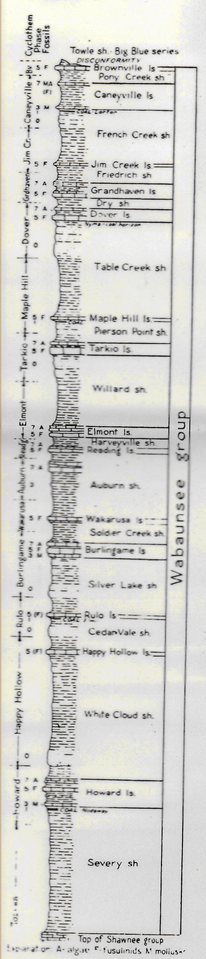


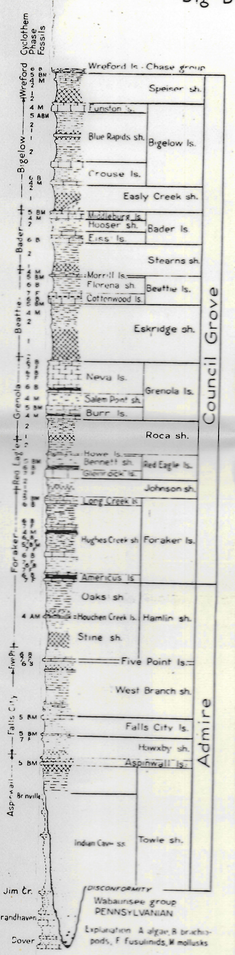


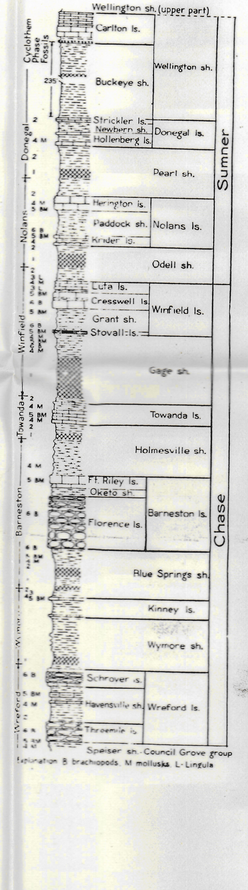
Virgil series

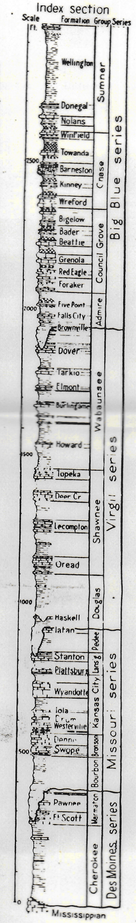


Big Blue series









Explanation of symbols

Limestone
Limestone cherty
Shale, clayey
Shale, sandy
Shale, black, Fissile
Coal
Red beds
Sandstone

Ideal Cyclothem of the Kansas Pennsylvanian

Phases

9 Unfossiliferous, ma. have land plant remains
8 Mollusks, or unfossiliferous
7 Algae, mollusks, brachiopods, bryozoans
6 Brachiopods, bryozoans
5 Fusulinids dominant, may have brachiopods, bryozoans etc. Culminating marine phase
4 Brachiopods, bryozoans
3 Mollusks, brachiopods, bryozoans
2 Mollusks, especially *Myalina*
1b Coal / Underclay
1a Land plants. May have land plant remains
0

Ideal Cyclothem of the Kansas "Permian"

Phases

1 Red shale / Green shale } No marine fossils
2 *Lingula* phase
3 Pelecypod phase
4 Pelecypod (*Allorisma, Pinna, Myalina*) and brachiopod phase
5 Brachiopod phase
6 Fusulinid phase
7 Brachiopod phase
8 Pelecypod (*Allorisma, Pinna, Myalina*) and brachiopod phase
9 Pelecypod phase
10 *Lingula* phase
11 Green shale / Red shale } No marine fossils

A cyclothem comprises the deposits of a sedimentary cycle.

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1934

Des Moines series

Bourbon formation

DISCONFORMITY

Nowata sh. (?)
Altamont ls. (?)
Bandera sh.
Pawnee ls.
Labette sh.
Fort Scott ls.
Marmaton group
Worland ls.
Mulberry coal
Lexington cap rock
Lexington coal
Summit coal
Mulky coal
Bevier coal
Ardmore ls.
Tebo coal
Jordan coal
COAL
Cherokee shale

Vertical Scale 250 FT. 200 150 100 50

DISCONFORMITY
MISSISSIPPIAN

Missouri series

Fontana sh. (Kansas City group)

Winterset ls.
Shirl. sh.
Canville ls.
Bethany Falls ls.
Hushpuckney sh.
Middle Creek ls.
Smiabar ls.
Dennis ls.
Galesburg sh.
Swope ls.
Ladore sh.
Hurrah ls.
Bronson
Bourbon Formation
Warrensburg channel sandstone
Worland ls.
Pawnee ls.
Lexington Cap rock
Upper ls.
Lower ls.
Lower Ft Scott
DISCONFORMITY
Des Moines series

Explanation: A algae, M mollusks, F fusulinids

Stranger fm. (Douglas group)

Iatan ls.
Weston sh.
Little Kaw ls.
Victory Jct. sh.
Olathe ls.
Eudora sh.
Captain Cr. ls.
Vilas sh.
Spring Hill ls.
Hickory Cr. sh.
Merriam ls.
Bonner Springs sh.
Farley ls.
Island Cr. sh.
Argentine ls.
Quindaro sh.
Frisbie ls.
Lane sh.
Raytown ls.
Muncie Cr. sh.
Paola ls.
Chanute sh.
Corbin City ls.
Cement City ls.
Drum ls.
Quivira sh.
Westerville ls.
Wea sh.
Block ls.
Fontana sh.
Winterset ls.
Stanton
Plattsburg
Wyandotte
Iola
Dennis
Swope
Hickory Creek
Bethany Falls
Lenapah
Nowata
Altamont
Kansas City
Lansing
Pedee

Explanation: A algae, B brachiopods, F fusulinids, M mollusks

Oread ls. (Shawnee group)

COAL
Amazonia ls.
Lawrence sh.
Ireland ss.
Haskell ls.
Vinland sh.
Iatan ls.
Tonganoxie ss.
Stranger fm.
Weston sh.
Stanton ls.
DISCONFORMITY
Missouri series

Douglas group

Virgil series

Topeka
Deer Creek
Calhoun
Deer Cr.
Tecumseh
Lecompton
Kanwaka
Oread
Shawnee group

Local Creek ls.
Holt sh.
Du Bois ls.
Turner Creek sh.
Hartford ls.
Iowa Point sh.
Sheldon ls.
Jones Point sh.
Ervine Creek ls.
Larsh-Mission Creek sh.
Rock Bluff ls.
Oskaloosa sh.
Grawkwie ls.
Nakes Creek sh.
Ost ls.
Kenosha sh.
Avoca ls.
King Hill sh.
Bell ls.
Queen Hill sh.
Big Springs ls.
Doniphan sh.
Spring Branch ls.
Stull sh.
Clay Creek ls.
Jackson Park sh.
Kereford ls.
Heumader sh.
Plattsmouth ls.
Heebner sh.
Leavenworth ls.
Snyderville sh.
Toronto ls.

Explanation: A algae, M mollusks, F fusulinids

Towle sh. Big Blue series
UNCONFORMITY
Brownville ls.
Pony Creek sh.
Caneyville ls.
French Creek sh.
Jim Creek ls.
Friedrich sh.
Grandhaven ls.
Dry sh.
Dover ls.
Table Creek sh.
Maple Hill ls.
Pierson Point sh.
Tarkio ls.
Willard sh.
Elmont ls.
Harveyville sh.
Reading ls.
Auburn sh.
Wakarusa ls.
Soldier Creek sh.
Burlingame ls.
Silver Lake sh.
Rulo ls.
Cedar Vale sh.
Happy Hollow ls.
White Cloud sh.
Howard ls.
Severy sh.
Top of Shawnee group
Wabaunsee group

Explanation: A algae, F fusulinids, M mollusks

Big Blue series

Wreford ls. Chase group

Speiser sh.
Funston ls.
Blue Rapids sh.
Crouse ls.
Easly Creek sh.
Middleburg ls.
Hooser sh.
Eiss ls.
Stearns sh.
Merrill ls.
Florena sh.
Cottonwood ls.
Eskridge sh.
Neva ls.
Salem Point sh.
Burr ls.
Roca sh.
Howe ls.
Bennett sh.
Glenrock ls.
Long Creek ls.
Hughes Creek sh.
Americus ls.
Oaks sh.
Houchen Creek ls.
Stine sh.
Five Point ls.
West Branch sh.
Falls City ls.
Howe sh.
Aspinwall ls.
Towle sh.
Indian Cave ss.
DISCONFORMITY
Wabaunsee group
PENNSYLVANIAN

Bigelow
Baker
Bader
Beattie
Grenola
Red Eagle
Foraker
Johnson
Nolans
Winfield
Towanda
Barneston
Wreford
Matfield
Funston
Blue Rapids
Crouse
Easly Creek
Middleburg
Hooser
Eiss
Stearns
Merrill
Florena
Cottonwood
Eskridge
Neva
Salem Point
Burr
Roca
Howe
Bennett
Glenrock
Long Creek
Hughes Creek
Americus
Oaks
Houchen Creek
Stine
Five Point
West Branch
Falls City
Howe
Aspinwall
Towle
Jim Cr.
Grandhaven
Dover
Admire
Council Grove
Sumner
Chase

Explanation: A algae B brachiopods, F fusulinids, M mollusks

Wellington sh. (upper part)

Carlton ls.
Buckeye sh.
Strickler ls.
Newberry sh.
Hollenberg ls.
Pearl sh.
Herington ls.
Paddock sh.
Krider ls.
Odell sh.
Lufa ls.
Creaswell ls.
Grant sh.
Stovall ls.
Gage sh.
Towanda ls.
Holmesville sh.
Ft. Riley ls.
Oketo sh.
Florence ls.
Blue Springs sh.
Kinney ls.
Wymore sh.
Schroyer ls.
Havensville sh.
Threemile ls.
Speiser sh.: Council Grove group

Explanation: B brachiopods, M mollusks, L Lingula

Index section

Scale Ft

Formation
Wellington
Donegal
Nolans
Winfield
Towanda
Barneston
Kinney
Wreford
Bigelow
Bader
Beattie
Grenola
Red Eagle
Foraker
Five Point
Falls City
Brownville
Dover
Tarkio
Elmont
Burlingame
Howard
Topeka
Deer Cr.
Lecompton
Oread
Haskell
Iatan
Stanton
Plattsburg
Wyandotte
Iola
Cherryvale
Westerville
Dennis
Swope
Bethany Falls
Lenapah
Nowata
Altamont
Pawnee
Ft Scott
Cherokee
Mississippian

Group
Sumner
Chase
Council Grove
Admire
Wabaunsee
Shawnee
Douglas
Kansas City
Bronson
Marmaton
Cherokee

Series
Big Blue series
Virgil series
Missouri series
Des Moines series

Index section

Explanation of symbols

Limestone, cherty
Limestone
Shale, clayey
Shale, sandy
Shale, black, fissile
Coal
Red beds
Sandstone

Ideal Cyclothem of the Kansas Pennsylvanian

Phases

9 Unfossiliferous, may have land plant remains
8 Mollusks or unfossiliferous
7 Algae, mollusks, brachiopods, bryozoans
6 Brachiopods, bryozoans
5 Fusulinids dominant, may have brachiopods, bryozoans etc. Culminating marine phase
4 Brachiopods, bryozoans
3 Mollusks, brachiopods, bryozoans
2 Mollusks, especially *Myalina*
1b Coal — Underclay
1a Land plants.
0 May have land plant remains

Ideal Cyclothem of the Kansas "Permian"

Phases

1 Red shale
2 Green shale } No marine fossils
3 *Lingula* phase
4 Pelecypod phase
5 Pelecypod (*Allorisma, Pinna, Myalina*) and brachiopod phase
6 Brachiopod phase
7 Fusulinid phase
6 Brachiopod phase
5 Pelecypod (*Allorisma, Pinna, Myalina*) and brachiopod phase
4 Pelecypod phase
3 *Lingula* phase
2 Green shale
1 Red shale } No marine fossils

A cyclothem comprises the deposits of a sedimentary cycle.

A megacyclothem comprises two or more cyclothems of different characters that occur in regular sequence.