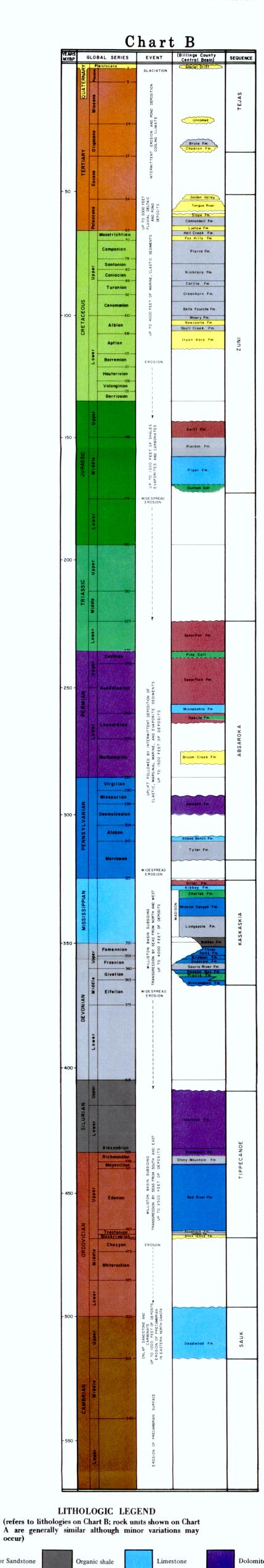
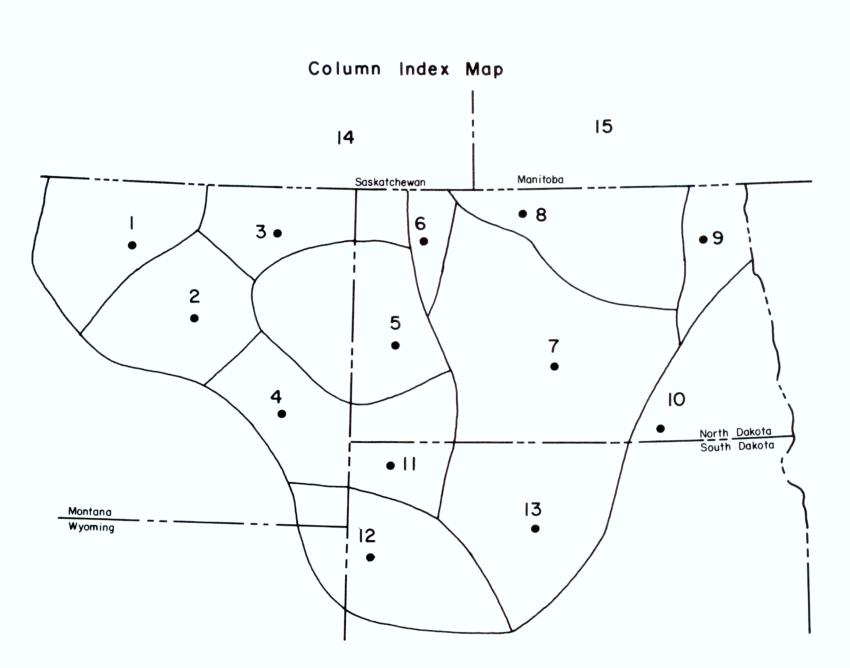
by John P. Bluemle, Sidney B. Anderson, and Clarence G. Carlson

1981

Chart A MONTANA NORTH DAKOTA SOUTH DAKOTA CAN																	
Pystem Globo	I Series/Stages	North American Stages	l Blaine - Valle y Northwest Bosin	2	3	4 Cedor Creek Anticline Southwest Bosin	5 Billings County Central Basin	6 Williams County Nesson Anticline	7 Burleigh County	8	9 Cavalier County Northeast Edge	IO Dickey County Southeast Edge	II Adams - Harding Southwest Basin	12	13	14 Southern Saskatchewan	IS Southern Manitoba
Holo- cene			alluvium	alluvium	alluvium	alluvium Yellowstone &	Oahe	Oahe	Oahe	Oahe	Oahe Damen Gardar	Oahe	Oahe	alluvium	alluvium	alluvium	alluvium
Quaternary Pleistocene	illazzian icilian imilian calabrian	Aftonian	glacial drift Some glaciofluvial deposits Mountains of terrace gravel	-	glacial drift Some glaciofluvial deposits Missouri deposits Missouri glacial drift Glacial drift Floxyille	A PAPA	e o lion deposits Missouri And Yellowstone terrace gravels Charging Eagle Floxville	Missouries growing and alociof luvial of the control of the contro	Snow School Horseshoe Valley Medicine Hill Dunn (Unnamed units) Charging Eagle	(Numerous named and unnamed glacial and glaciofluvial units)	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Gardar (At least three additional glacial and glaciofluvial units recognized)	eolian deposits		(numerous unnamed glacial and glaciofluvial deposits)		Laurentide drift
Pliocene	Piacenzian Zanclean 5.2 Messinian			····?···?··/~	?? 			···········					09allala	Ogolio lo		Saskatchewan	
Miocene Middle Hoo	Serravallian Langhian 15 Burdigalian 22.5	Barstovian Hemingfordian Arikareean					-{Unnamed >-		L'Unnome d				Arikaree	Arikaree		Wood Mountian	
Tertiary Oligocene	Rupelian	Whitneyan Orellan Chadronian Duchesnian Uintan					Brule		Brule				Brule Chadron	Brule		Cypress Hills	
	Lutetian 49 49 49 49 Thanetian 60 Danian	Bridgerian Wasatchian Clarkforkian Tiffanian Torrejonian Puercan		Tongue River Lebo Tullock Hell Creek	Tongue River Lebo Tullock Hell Creek	Lebo Tullock Hell Creek	Bullion Creek Slope Connonball Ludlow Hell Creek	Cannonball Hell Creek	Golden Valley Sentinel Butte Bulton Creek undiff Ludlow/ Hell Creek	Slope Cannonball Ludlow Hell Creek			Tongue River Slope Cannonball Fort Union Ludlow Hell Creek	Fort Union Hell Creek	Fort Union The III Creek	Ravenscrag Frenchman Baffle	Turtle Mountain
Cretaceous Lower Upper	Cenomanian Santonian Santonian Ceniacian Turonian Cenomanian Cenomanian Aptian Barremian B		Fox Hills Bearpaw Judith River Clagget Logget A Telegraph Cr. Niobrara Carille Greenhorn Belle Fourche Mowry Muddy Skull Creek Basal Colorade Silt Dakota Kootenai Lakota	Fox Hills Bearpaw Judith River Claggett Eagle Telegraph C. Niobrara Greilie Greenharn Belle Fourche Mowry Muddy Skull Creek Basal Colorado Silt Dakota Kootenai Lakota	Fox Hills Bearpow Judith River Claggett Eagle Telegraph Cr. Niobrara Greenhorn Belle Fourche Mowry Muddy Skull Creek Basal Colorado Silt Dokota Kootenai Lakota	Fox Hills Bearpaw Judith River Claggett Claggett Eagle Telegroph Cr. Niobrara Carille Greenhorn Delle Fourche Mowry Skull Creek Basal Colorado Sitt Dakota Kootenai Lakota	Pierre Pi	Pierre Pierre Niobrara Carille Greenhorn Belle Fourche Mowry Newcastle Skull Creek Inyan Kara	0	Pierre Niobrara Carille Greenharn Delle Fourche Mowry Newcastle Skull Creek Inyan Kara	Pierre Niobrara Carllie Greenhorn Newcastle Skull Creek Inyan Kara	ONIODATO OS SECTION OS	Pierre Niobrara Carlile Greenhorn Belle Fourche Mowry Newcastle Skull Creek Fall River/Lakota		Pierre Niobrara Carlile Greenhorn Belle Fourche Dakota Skull Creek Fall River	Whitemud Ecostend Bearpow Belly River Foremost Lea Park Ist White Specks 2nd White Specks Viking Joll Fou	Boissevain Riding Mountain Second Person Person
Mesozoic Jurassic ower Middle Upper	Tithonian Kimmeridgian Oxfordian Callovian Bathonian Bajocian Aalenian Toarcian Pliensbachian Sinemurian		Swift Swift Rierdon Piper	Morrison Swift Rierdon Piper Nesson	Swift Rierdon Piper Nesson	Morrison Swift Rierdon Piper Nesson	Swift Rierdon Piper	Swift Rierdon Piper Dunham	Swift Rierdon Piper Ounhom	Swift Rierdon Piper	Swift/Rierdon	Swift	Sundance Piper	Morrison Sundance Piper	Sundance	Vanguard Shaunovan Gravelbourg Upper Watrous	Waskada Melita Reston Upper Amaranth
Permian Triassic Lower Upper L M U L	Rhaetian 200 Norian 20	Ochoan Guadalupian Leonardian Wolfcampian		Minnelusa	Spearfish Pine Salt Spearfish Minnekahta Opeche Minnelusa	Spearfish Minnekahta Opeche	Spearfish Pine Salt Spearfish Minnekahta Opeche Broom Creek	Spear fish Pine Salt Spear fish Minnekohta	Spearfish Pine Satt Minnekahta Opeche Broom Creek				Broom Creek	Spearfish Minnekahta Opeche Cassa/Broom Creek	1	Lower	Lower
arboniferous Middle Upper	Stephanian 295 Westphalian/ Moscovian 315 Bashkirian 325 Serpukhovion	Virgilian Missourian Desmoinesian Atokan Morrowan Chesterian	Big Snowy	Minnelusa Amsden Tyler Heath Kibbey	Mid a Lower Minnelusa Amsden Tyler B.S. Kibbey	Amsden Tyler B.S. Offer Kibbey	Amsden Alaska Bench Tyler Ofter Kibbey	Tyler	Amsden Alaska Bench Tyler Ofter Kibbey				Hayden Roundtop Reclamation Fairbank	Wendover Meek Hayden Roundtop Reclamation Fairbank	"Minnelusa" Reclamation Fairbank	Kîbbey	
oic C Lower	Visean 340 Tournaisian 550 Famennian Frasnian	Meramecian Osagian Kinderhookian Conewangoon Cossadagan Chemungian Fingerlokeian	Charles Mission Conyon Lodgepole Bakken Potlatch Three Forks Birdbear "Nisku" Duperow Souris River	Charles Mission Canyon Lodgepole Bakken Three Forks Ouperow Souris River	Charles Charles Mission Conyon Lodgepole Bakken Three Forks Birdbear "Nisku" Duperow Souris River	Charles Cha	Charles Charles Mission Canyon Lodgepole Bakken Three Forks Birdbear Duperow Souris River	Charles Conyon Mission Conyon Lodgepole Bakken Three Forks Birdbear Duperow Souris River	Charles O Mission Conyon Lodgepole Carrington Bakken Three Forks Birdbear Duperow Souris River	Charles Charles Mission Canyon Lodgepole Carring Form Bakken Three Forks Bird bear Duperow Souris River			Charles Mission Canyon Mission Canyon Lodgepole Englewood Three Forks Birdbear Duperow Souris River	Charles Charles Mission Conyon Lodgepole Englewood	Mission Canyon Lodgepole Englewood	Poplar Ratcliffe Midale/Frobisher Alida Tilston Souris Valley Calville Big Valley Torquay Birdbear Duperow Souris River	Mission Conyon Souris Valley Routledge Calville Lyleton Birdbear Duperow Souris River
Silurian Devonian	Pridolian Ludlovian Wenlockian	Esopusian Deerparkian Helderbergian Cayugan Lockportian Cliftonian Clintonian Alexandrian		Towson Bay	Dawson Bay Prairie Winnipègasis	Ashern Interlake		Dawson Bay Prairie Winnipegasis Interlake	Dowson Bay Prairie Winnipegosis Inter la ke	Dowson Bay Prairie Winnipegosis Interlake			Dawson Bay Prairie Winnipegos is		امر Interlake	Prairie Winnipegosis Ashern Interlake	Prairie Winnipegosis Ashern
Ordovician Middle Upper	Ashgillian Caradocian Llandeilian Llanvirnian 485	Richmondian Maysvillian Edenian	Stonewall Stoughton Red River Winnipeg	Stone wall Gunton Gunton Stoughton Red River Winnipeg	Stonewall Gunton Gunton Stoughton Red River Winnipeg	Stonewall Gunton Stoughton Red River Winnipeg	Stonewall Stony Mountain Red River Roughlock ICEDIX Block Island	Stonewall Stony Mountain Red River Roughlock Cebox Black Island	Red River	Stonewall Stony Mountain Red River Roughlock Cobox	Stonewall Stony Mountain Red River Roughlock Coronal Cor	Red River	Stonewal I Stoughton Gunton Red River Winnipeg	Stony Mountain Red River Winnipeg	Stonewalt Stony Mountain Red River Winnipeg	Stonewall Stony Mountain Red River Winnipeg	Stonewall Stony Mountain Red River Winnipeg
Cambrian G Lower	515	Canadian Trempeleauan Franconian Dresbachian Albertan	Zoatman	Emerson	Deadwood	Deadwood	Deadwood	Deadwood	Deadwood	Deadwood		De adwood	Deadwood	Deadwood	Deadwood	Deadwood (Sandstone)	De ad wood
Precambrian	Proteroz	2500	Crystalline Metamorphic Rocks Blaine-Valle y Northwest Basin	Pegmatite & Amphibolite Garfield-McCone North Basin	Adamellite Roosevelt County West Basin	Crystalline Metamorphic Rocks CedarCreek Anticline Southwest Basin	Granodiorite 8 Amphibolite Schist Billings County Central Basin		Granite Gneiss		Amphibolite	Green Schists	Adamelite Adams-Harding Southwest Basin	Granite Pegmatite Pennington Count Black Hills		Igneous & Metamorphic Rocks Southern Saskatchewan	Igneous & Metamorphic Rocks Southern Manitoba





The numbered columns on Chart A correspond to the areas designated on this map; Chart B corresponds to area 5 on this map. Within each area, the X corresponds to the approximate location of a well that is typical of that area. However, each column is representative of the entire area,

as shown on this index map.

WILLISTON BASIN STRATIGRAPHIC NOMENCLATURE CHART

Redbeds; sand and shale

Chart A is a correlation chart of chronostratigraphic units of the Williston Basin. It compares 15 areas in Montana, North Dakota, South Dakota, Saskatchewan, and Manitoba (see index map). The units included are those in use by geologists working in the Basin; they are units that are widely

recognized and commonly picked on geophysical logs. The variable vertical scale used on Chart A has been either compressed or expanded for convenience in drafting, depending on the number of recognized units that occur within the various time intervals and the amount of detail shown. The geochronometric scale (numerical time scale in millions of years) varies accordingly. For example, the two million years of Quaternary time require about two vertical inches; the 40 million years of Triassic time require less than one inch because few units of Triassic age are recognized. Absolutely no connotation of thickness of units can be inferred from the columns on either Chart A or B.

The left-hand columns on Chart A list Global Series/Stages and North American Stages that are adapted from the AAPG Correlation of Stratigraphic Units of North America (COSUNA) research project. Although most of the series and stage names are not widely used by geologists working in the Williston Basin, they are included here for the sake of completeness, and to allow more precise comparisons and correlations with other areas. Wavy lines generally represent unconformities and show that the time-section (geologic time) is incompletely represented. The horizontal scale within each column represents lateral continuity in a very general sort of way. For example, a wavy line sloping downward and to the right on top of a formation shows that the preserved section to the east is older than it is to the west. A unit that does not extend all the way across a column is present in only part

of the area represented by the column. The erosional events depicted on the stratigraphic columns (both Charts A and B) were of unknown length. An unknown amount of older rock, above a given level (the surface of the unconformity), was eroded. For example, a period of erosion was interrupted when Winnipegosis sedimentation began in Devonian time. This erosion had removed any Silurian and Devonian rocks that may have rested on top of the Interlake Formation, as well as removing undetermined amounts of the Interlake Formation itself, depending on geographic location within the Basin. Rocks of uppermost Silurian and Lower Devonian age are absent. We do not know for certain whether they ever existed in the area. If rocks of these ages were once present, they were eroded prior to Winnipegosis sedimentation. We know, therefore, that the erosional episode ended during the Middle Devonian. It may have started any time after

Interlake deposition. Chart B is a stratigraphic column of the central Williston Basin (McKenzie-Billings County area of western North Dakota, comparable to area 5 on the column index map and column 5 on Chart A) drawn using a linear time scale on which one vertical inch equals 24 million years. The column shows geologic time and the events that occurred throughout geologic time, and it shows the preserved sedimentary rock section. The preserved formations correspond to regional sedimentary rock sequences (farthest right column on Chart B) that can be correlated over much of the North American continent. These charts are working versions, subject to revision. Some of the correlations and some of the nomenclature are controversial. We ask for constructive criticisms and comments to enable us to improve future editions of the chart. All letters received will be acknowledged and all information will be assessed

and applied as revisions or additions. We are indebted to the following people for help in preparing the Montana and South Dakota portions of the charts: Jim Cannon, John Graham, Bill Hupp, Carl Kendall, Harold Silkwood, Fred Steece, Jim Stenson, Dan Vice, and Mike Walen.