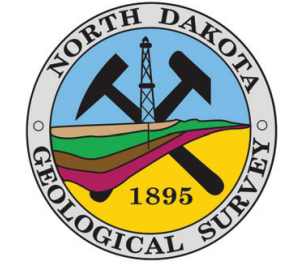


# NORTH DAKOTA STRATIGRAPHIC COLUMN

North Dakota Geological Survey  
Geologic Investigations No. 230

# DEADWOOD WINNIPEG SUMMARY DRILL STEM TESTS AND PRODUCTION MAPPING

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2020

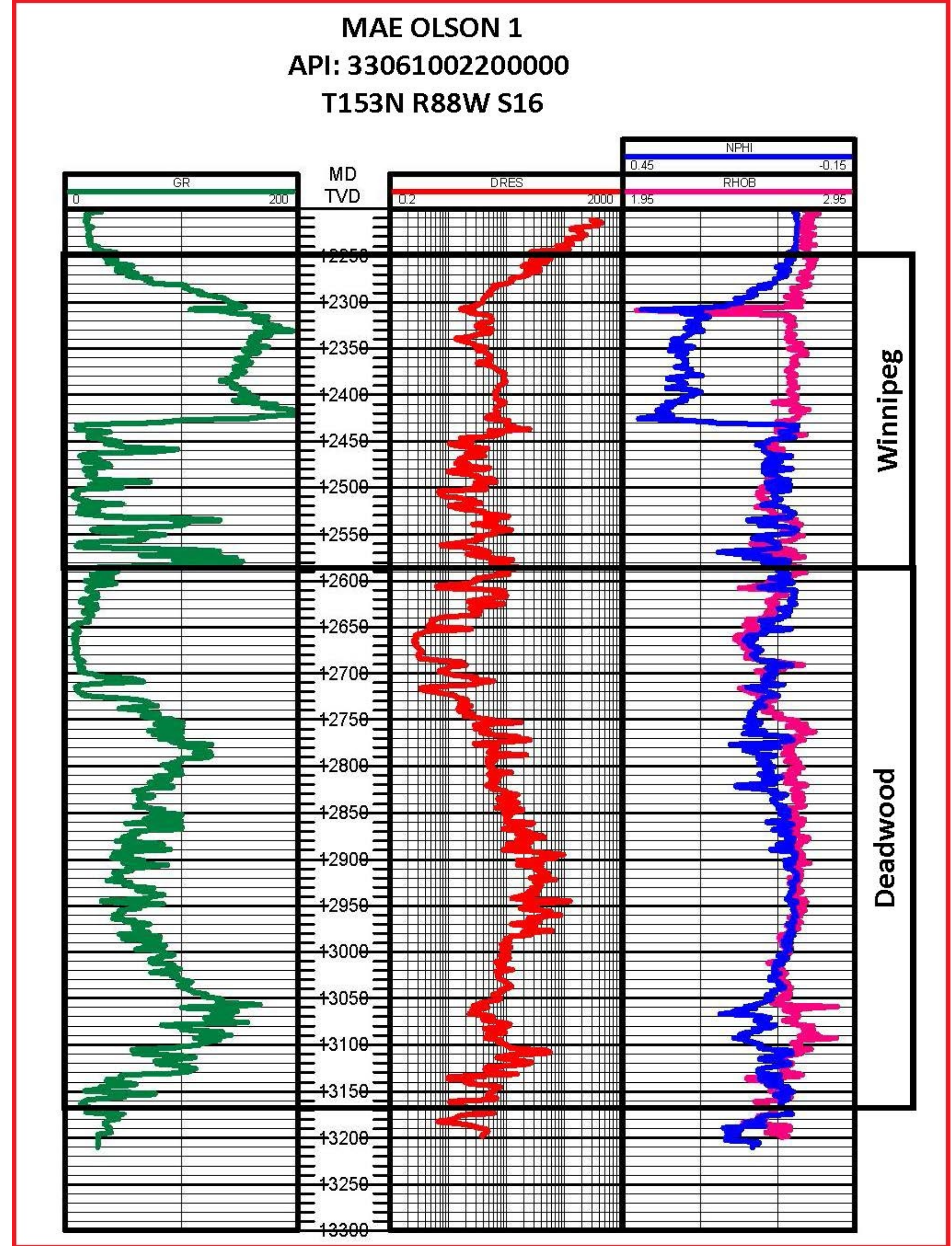
AGE MILLIONS OF YEARS BEFORE PRESENT	ERATHEM	SYSTEM	SEQUENCE	ROCK UNIT						
				GROUP	FORMATION	MEMBER				
0.0-2.6	QUATERNARY	Holocene	TEXAS	OAHE	RIVERDALE PICK CITY AGASSIZ BROWN MALLARD ISLAND					
2.6-0.01		Pleistocene		COLEHARBOR	WEST CENTRAL	PROVIDENCE VALLEY SIBBICK BROOKS RIVER FALCONER BUTT ARNDTVILLE WYDE BENTLEY FALLS				
					SOUTH SCHOOL	WELLS CHICKEN FERRY ST. BELLAIR CAMP GRANTON BARFORSK				
					ROBERTSON VALLEY					
					BEVERLY HILL					
2.4-5.3	NEOGENE	Pliocene	(Unnamed Unit)							
5.3-23.0		Miocene	WHITE RIVER	BRULE	SOUTH HEART CHALKY BUTTES					
23.0-33.9				CHADRON						
33.9-55.8	Eocene	GOLDEN VALLEY		CAMELS BUTTE BEAR DEN						
55.8-65.5			TERTIARY PALEOGENE	FORT UNION	SENTINEL BUTTE					
65.5-0.01	Palaeocene	BULLION CREEK								
		SLOPE								
		CANNONBALL								
		LUDLOW								
		HELL CREEK			BREEN COLGATE & LINTON BULLHEAD TIMBER LAKE YEAH CITY					
65.5-99.6	CRETACEOUS	Upper	MONTANA		ODANAH					
99.6-145.5				Lower	PIERRE		DEGREY GREGORY FEMINA GAMMON			
						COLORADO		NIOBRARA CARLILE GREENSHORN BELLE FOURCHE		
							DAKOTA		MOWRY NEWCASTLE SKULL CREEK INYAN KARA	
									SWIFT	
						145.5-201.6	JURASSIC	RIERDON		BOWEN FREMONT TAMICO KLINE PICARD DUNHAM
201.6-251.0		TRIASSIC		SAUDE PINE BELFIELD						
				SPEARFISH MINNEKAHTA						
				OPECHE						
251.0-299.0		PERMIAN	BROOM CREEK		AMSDEN ALASKA BENCH					
299.0-318.0				MISSISSIPPIAN	MADISON		TYLER OTTER KIBBEY			
						CHARLES				
318.0-359.0	CARBONIFEROUS	MADISON	MADISON		MISSION CANYON					
359.0-416.0				RASKASKIA	LODGEPOLE		BAKKEN THREE FORKS BIRDBEAR DUPEROW			
						DEVONIAN	MANITOBA		SOURIS RIVER DAWSON BAY	
								ELK POINT		PRAIRIE MOUNTAIN BELLE PLAINE ESTERHAZY
		416.0-444.0	SILURIAN			INTERLAKE			WINNIPEGOSIS ASHERN	
444.0-488.0				TIPPECANOE	BIG HORN			STONEWALL STONE MOUNTAIN STOUGHTON		
								RED RIVER		
								ROUGHLOCK ICEBOX BLACK ISLAND		
488.0-542.0	ORDOVICIAN	WINNIPEG								
542.0-570.0			CAMBRIAN	SASK		DEADWOOD				
	570.0-590.0	PRECAMBRIAN			WYOMING PROVINCE		STRUCTURAL PROVINCES TRANS-HUDSON OROGEN SUPERIOR PROVINCE			

In order to better facilitate petroleum exploration and development in the Williston Basin, the North Dakota Geological Survey (NDGS) has published a series of production-related maps and corresponding data sets. These maps sets include production and drill stem test (DST) results with an accompanying spreadsheet for easy data extraction. The primary goal of this project is to create a database showing the distribution of hydrocarbons within each productive unit.

Prior to this project, over 55% of the DST results in the state did not have an associated geologic interval. The NDGS utilized a series of filters in Petra and Excel to unite formation tops with DST results. Now over 95% of DST results are associated with a geologic interval. After removing failed (misrun) DSTs, the remaining DST results were then separated into three groups. The first group (Positive DSTa) contains wells that have recovered oil or gas (in either the drill pipe or the sampler), or those that list oil or gas as the primary component of the fluid/gas mixture (e.g. 10' mud cut oil) in the description. Secondly, Positive DSTb wells display results for oil or gas as the secondary component of the fluid/gas mixture (e.g. 50' gas cut mud). Although Positive DSTb wells do show signs of hydrocarbons, the hydrocarbon signal is considered weaker than those in the Positive DSTa group. Lastly, the Negative DST results have no indication of hydrocarbons. Detailed information for each DST (time-pressure data, interval depths, fluid and gas recovery information) can be accessed through the well file database maintained by the North Dakota Industrial Commission (NDIC) Oil and Gas Division.

Production for each well was determined using the NDIC's Production Pools and associated monthly production totals. The production pools utilized are shown on the Production Map for each interval. Cumulative production for each well was calculated through September 2019.

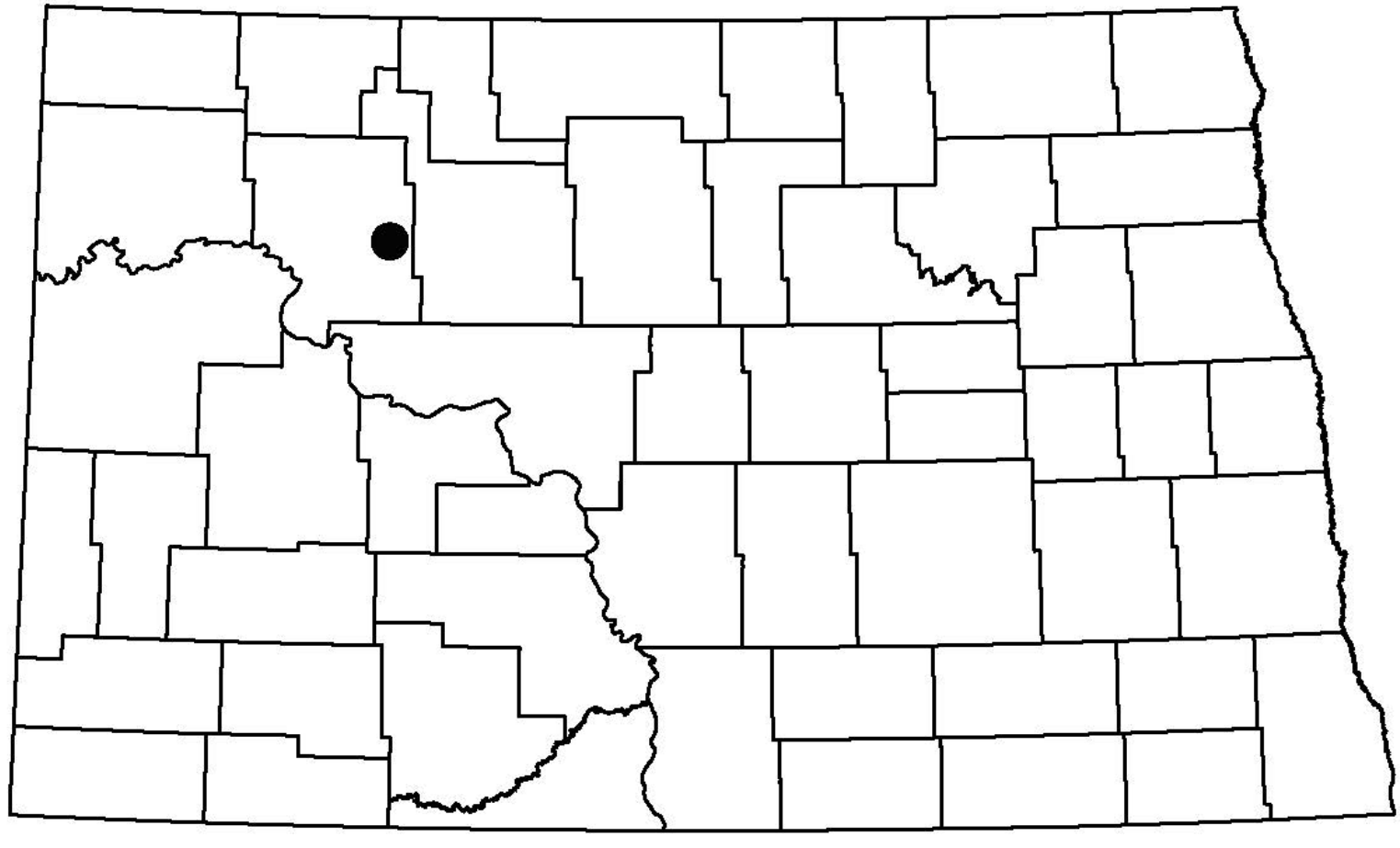
This project is a summary of the Deadwood and Winnipeg Formations' production and drill stem test results. Map sets include a production map, cumulative production map and DST results in North Dakota's portion of the Williston Basin. The Deadwood and Winnipeg Formations are highlighted by the red box on the North Dakota Stratigraphic Column on the left. A representative log of the Deadwood and Winnipeg Formations is shown below along with a map showing the well's approximate location.



### References

- Murphy, E.C., Nordeng, S.H., Juenker, B.J., and Hoganson, J.W., 2009, North Dakota Stratigraphic Column, North Dakota Geological Survey, MS-91, 1p.
- North Dakota Industrial Commission, Department of Mineral Resources, Oil and Gas Statistics, retrieved October 2019, <https://www.dmr.nd.gov/oilgas/>

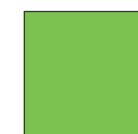
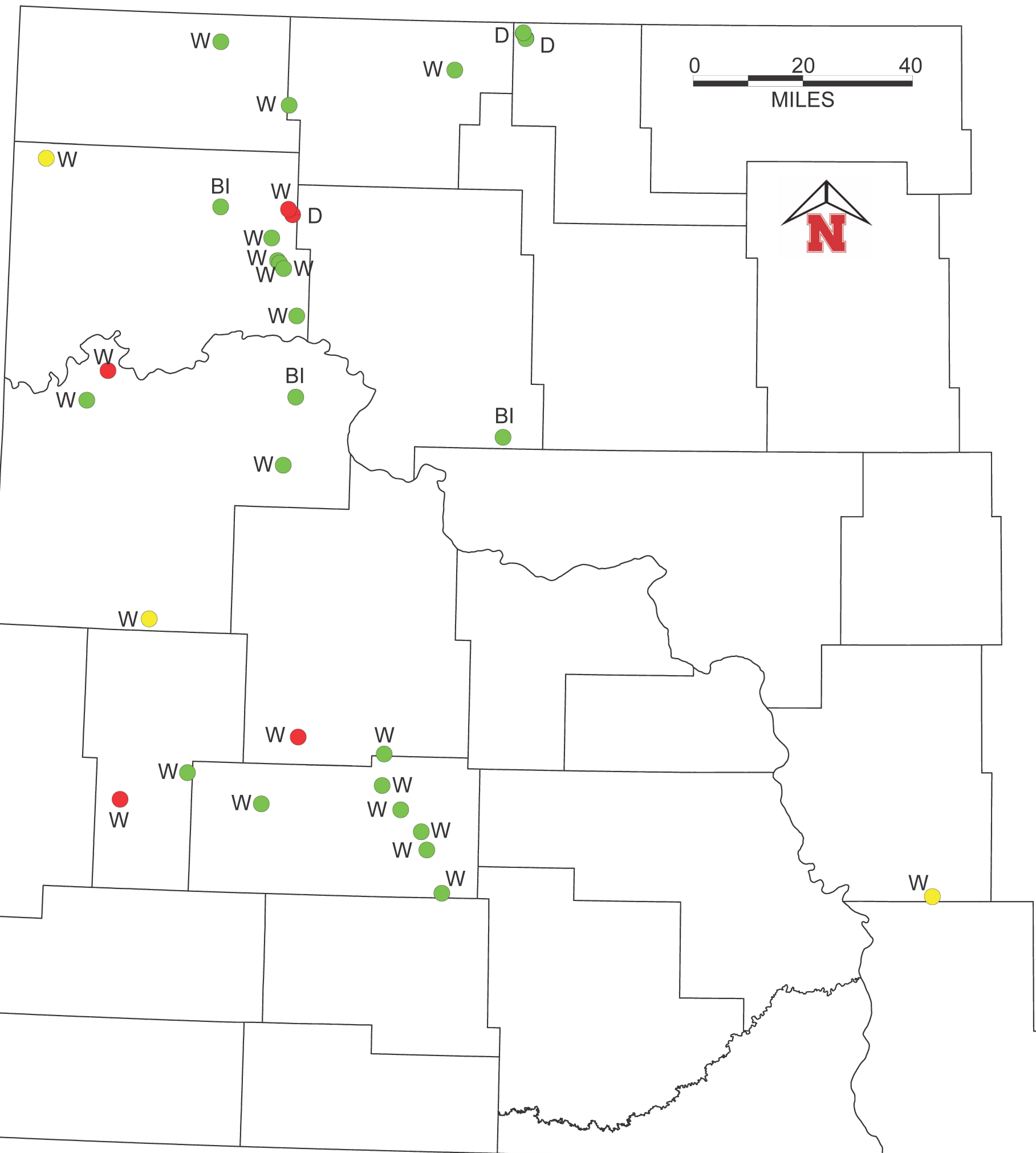
### NORTH DAKOTA LOCATION MAP





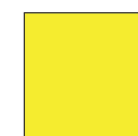
# DEADWOOD and WINNIPEG DRILL STEM TEST RESULTS

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2020



### POSITIVE DSTa

- (1) Oil or gas recovered in sampler and/or pipe (e.g. 275' Free Oil)
- (2) Description with oil or gas as the primary component of fluid/gas mixture (e.g. 150' mud cut Oil)



### POSITIVE DSTb

- (1) Description with oil or gas as the secondary component of fluid/gas mixture (e.g. 150' Gas cut mud)
- (2) Hydrocarbons present but a weak indication in DST



### NEGATIVE DST

- (1) No Oil or Gas reported

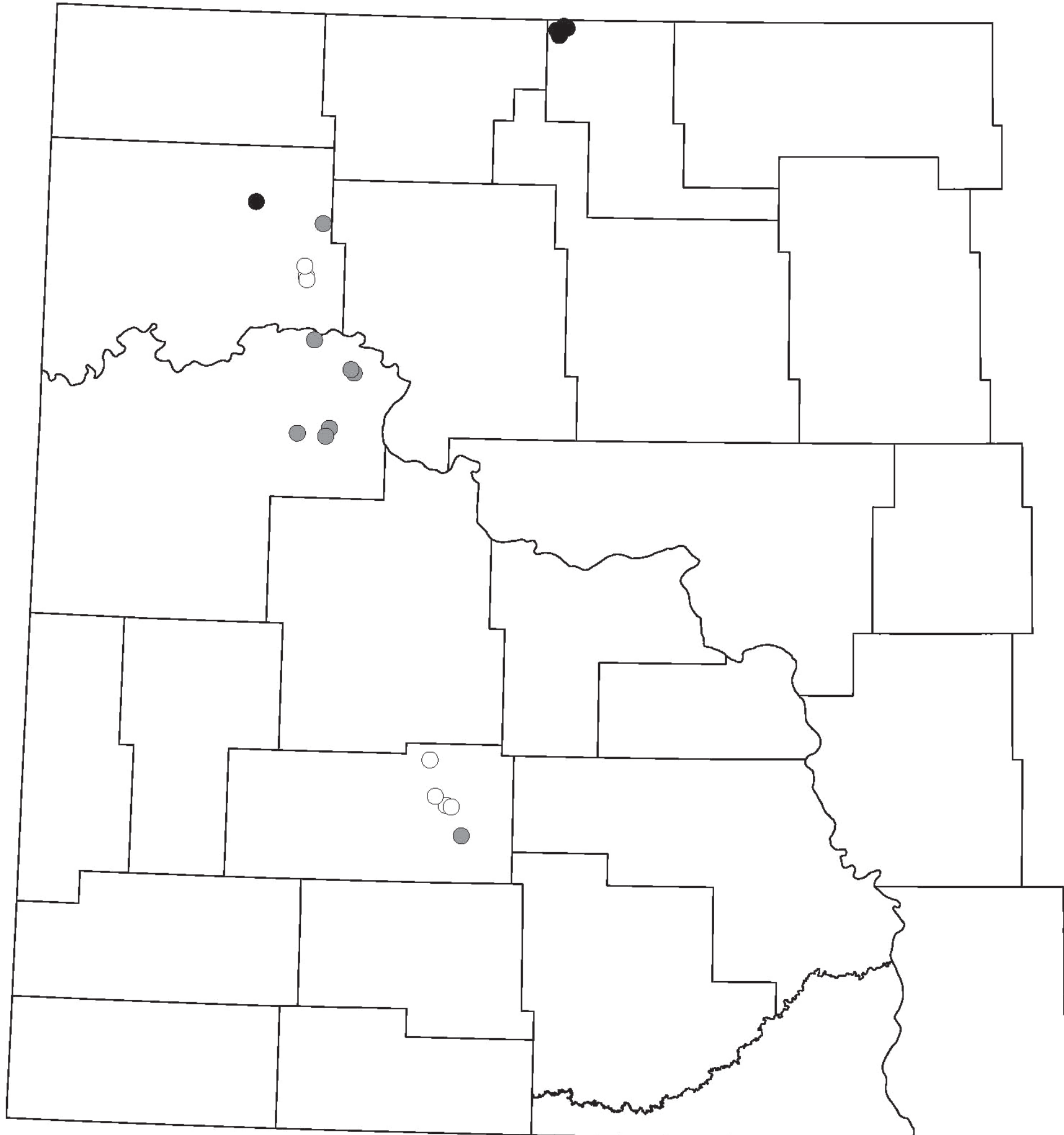
### MAP ABBREVIATIONS




- D - DEADWOOD DST
- BI - BLACK ISLAND DST
- W - WINNIPEG DST



# DEADWOOD and WINNIPEG OIL PRODUCTION

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2020



-  Deadwood Production
-  Winnipeg Production
-  Deadwood-Winnipeg Production

### NDIC Production Pools Utilized

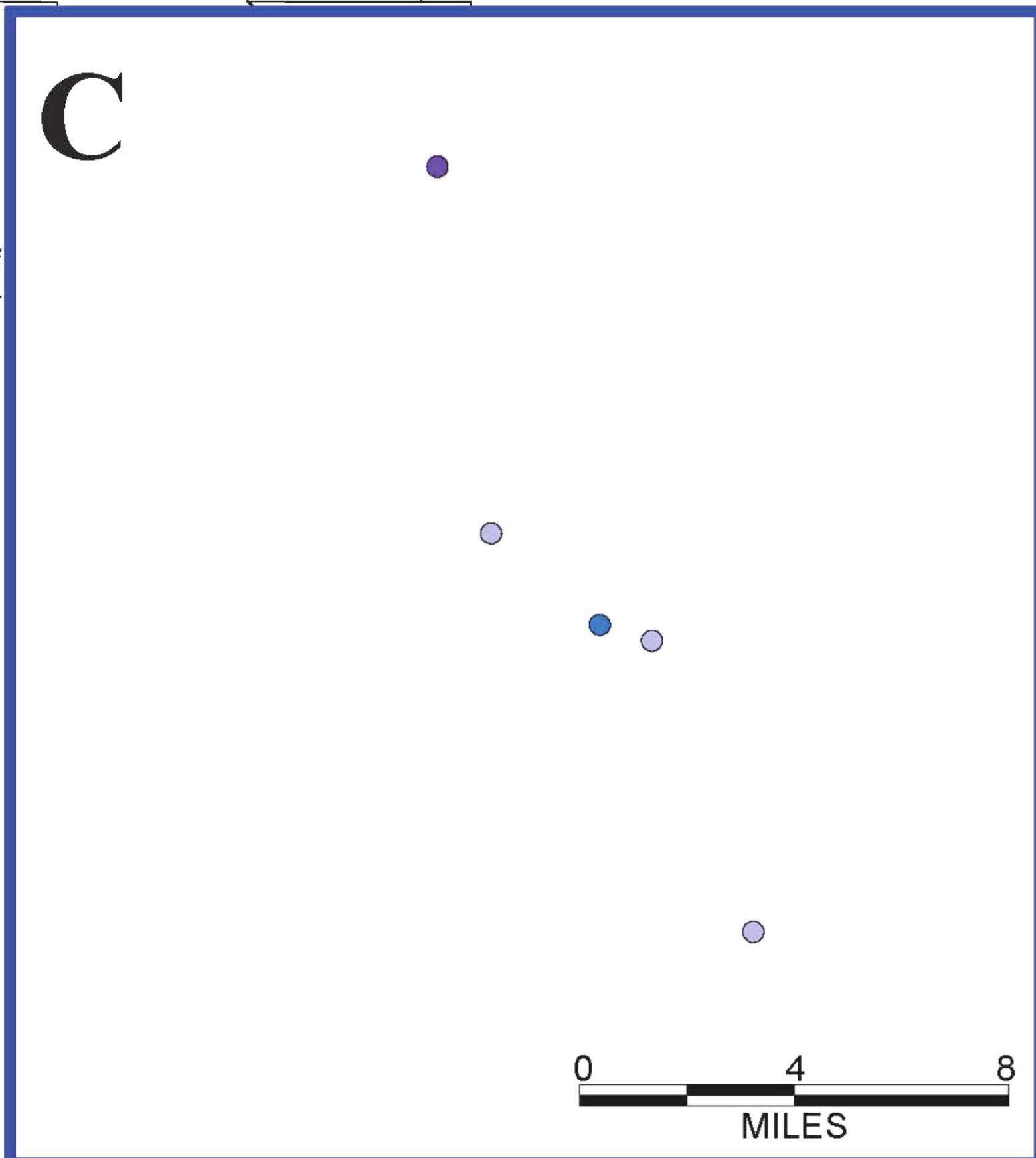
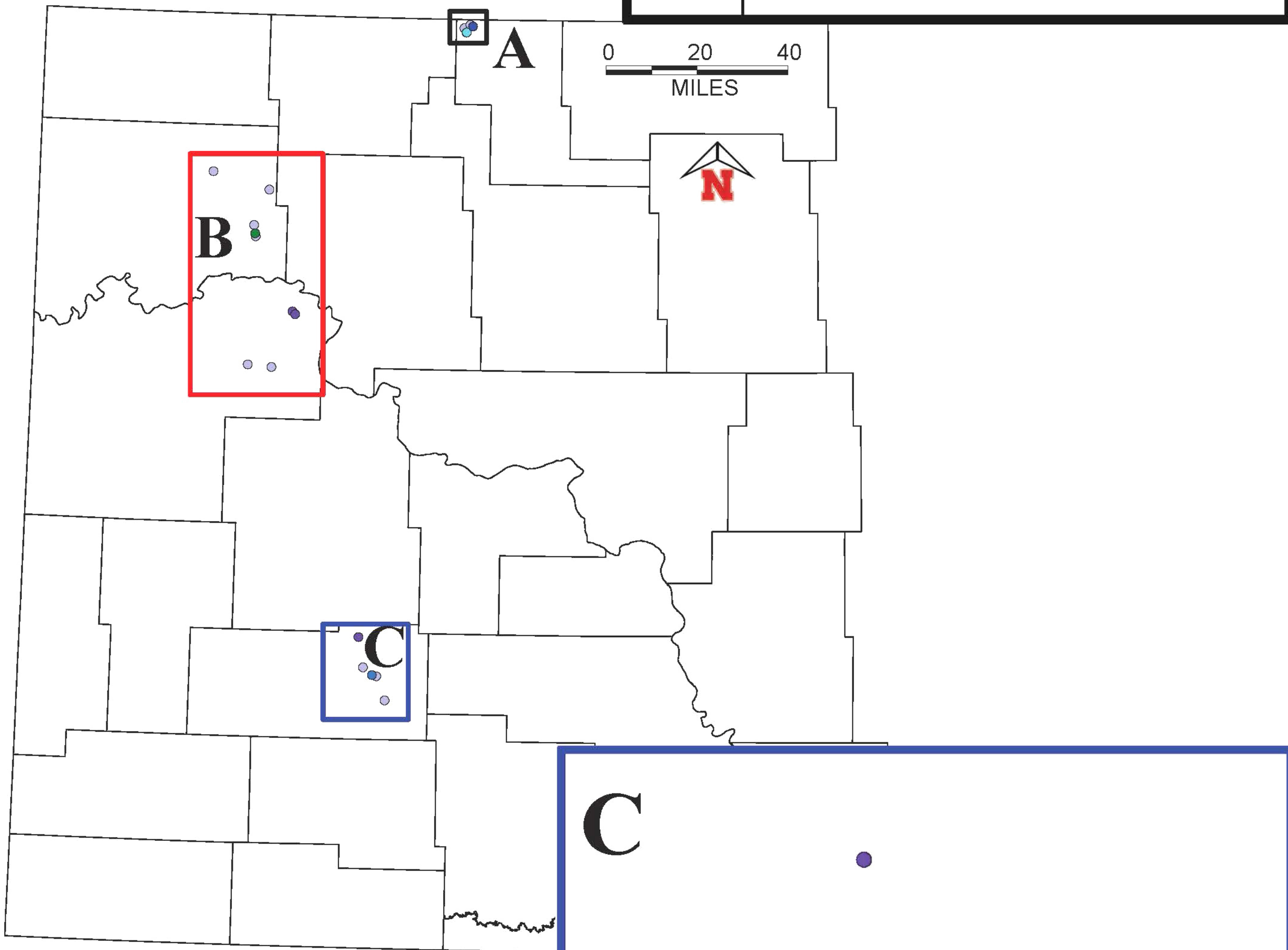
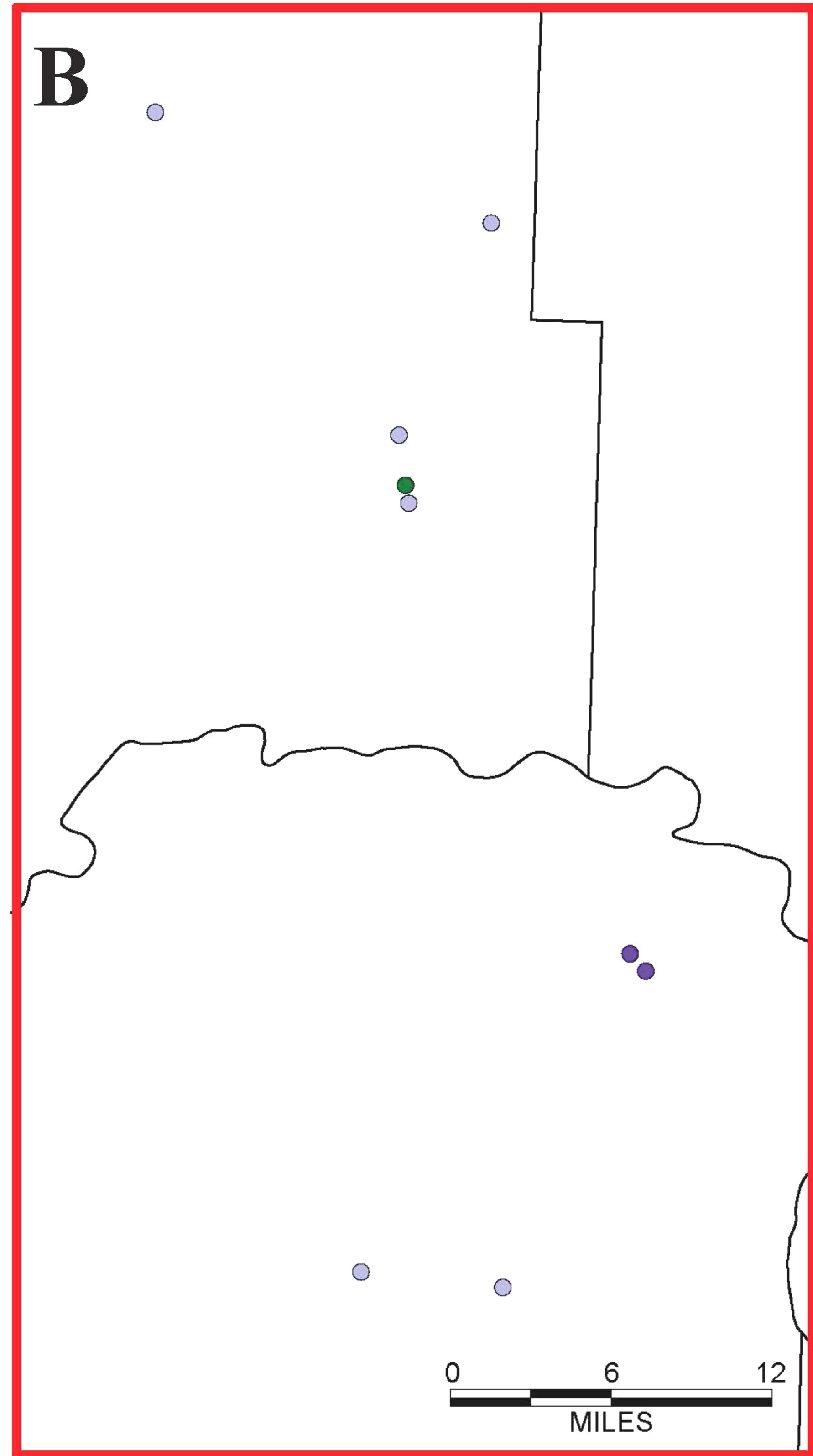
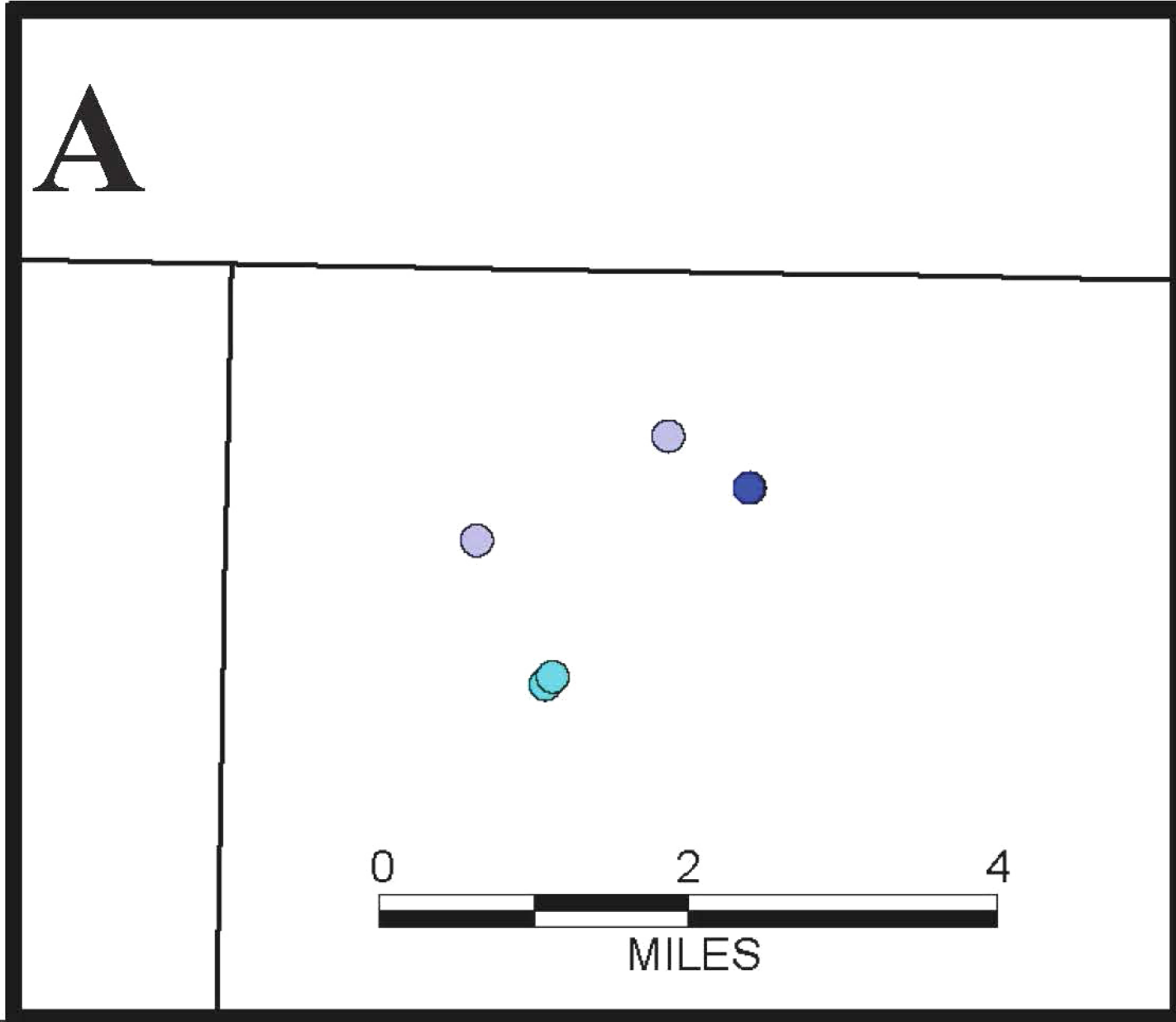
- Deadwood
- Cambro/Ordovician
- Winnipeg/Deadwood
- Winnipeg





# DEADWOOD and WINNIPEG CUM OIL PRODUCTION

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2020



## CUM OIL (BBLS)

