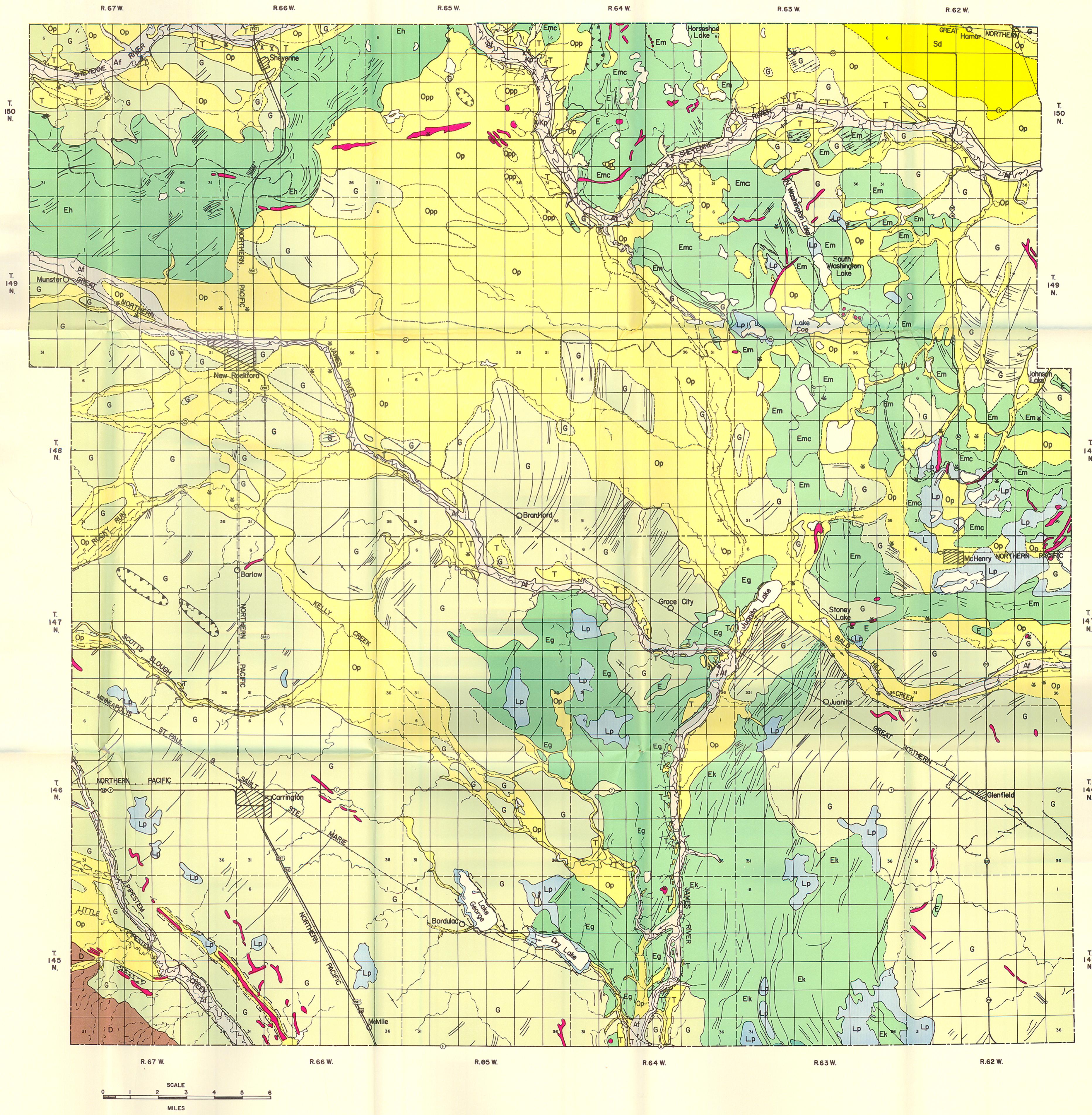


### GEOLOGIC MAP OF EDDY AND FOSTER COUNTIES, NORTH DAKOTA

## EXPLANATION

GLACIAL LANDFORMS	
	End Moraine. A ridge-like accumulation of drift, chiefly till, with surface to high local constructional relief generally greater than 100 feet per square mile with an overall and/or internal linear pattern (lines represent individual crests).
	Lake Plain. Gently undulating to nearly flat accumulation of drift, chiefly silt and clay, generally stratified.
	Outwash Plain. Gently undulating to nearly flat accumulation of drift, chiefly sand and gravel, generally stratified.
	Eg Grace City end moraine. An accumulation of bouldery drift with steep slopes, local relief averaging from 25 to 50 feet per square mile, height in the outer festooned part; a ridge-like configuration of hills varying from one-half to over nine miles wide.
	Eh Heindal end moraine. An accumulation of drift with gentle slopes, isolated areas of minor ridges, and local relief averaging from two to six miles wide.
	Ek Kensel end moraine. An accumulation of bouldery drift with moderately steep slopes, pronounced internal linearity and local relief between 20 and 50 feet per square mile except locally where it is greater; the overall width of from one to eight miles, greatest on the south.
	Em McHenry end moraine. An accumulation of silty drift with steep slopes, overall linearity and local relief averaging 50 to 100 feet per square mile except locally; a four to six miles band of hills.
	Emc Collapsed McHenry end moraine. A part of the McHenry end moraine with large depressions and intervening areas of collapsed outwash.
	Gd Ground Moraine. A gently undulating accumulation of drift, chiefly till, with low local constructional relief, generally less than 20 feet per square mile; commonly occurs behind end moraine.
	D Dead-Ice Moraine. A hummocky accumulation of drift, chiefly till, lacking linear trends, with high constructional relief, numerous kettle holes, integrated drainage and ice-distintegration features.
STREAMS	
	Perennial
	Intermittent
BEDROCK	
	Opp Bedrock Exposure. An outcropping of Cretaceous Pierre Shale.
MAP SYMBOLS	
	Kettle Chain. A group of kettles that form a linear pattern.
	State Highway
	Federal Highway
	Railroad
	Gravel Pits. Only the more important pits are shown.
	Contacts. Dashed where approximately located.
	Continental Divide



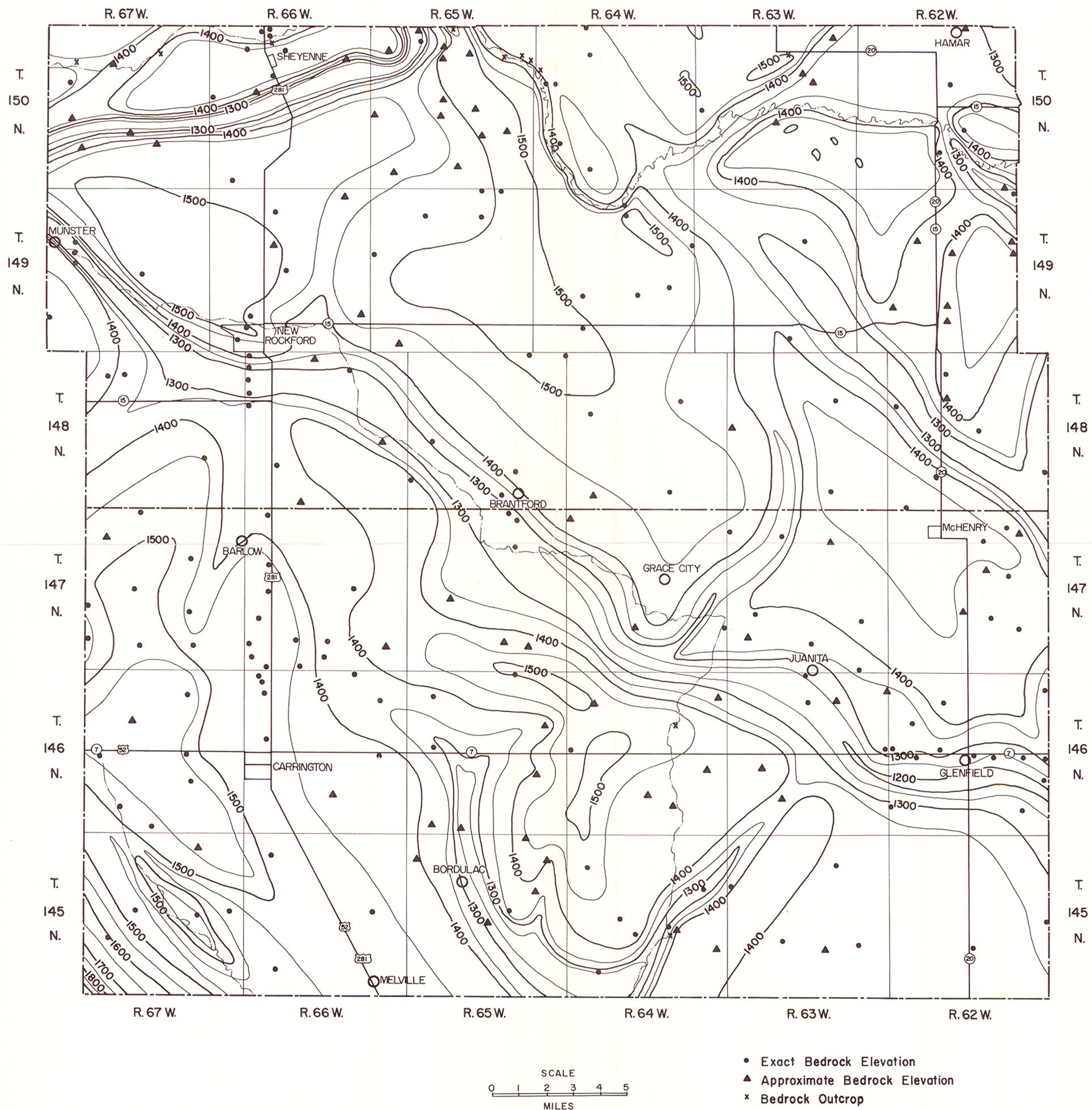


PLATE 2. Topographic map of the bedrock surface of Eddy and Foster counties.

TABLE 2

Grain size analyses of till in Eddy and Foster Counties. The samples are grouped according to the drifts from which they were taken; the landform each sample was taken from is listed.

## I. Kensal Drift

Location	Landform	Percentages		
		Sand	Silt	Clay
SW corner sec. 34, T. 145 N., R. 64 W.	end moraine	48	31	21
Center sec. 23, T. 145 N., R. 64 W.	end moraine	40	30	30
SW side sec. 2, T. 145 N., R. 64 W.	end moraine	32	37	31
SE corner sec. 23, T. 146 N., R. 64 W.	end moraine	49	36	15
SW corner sec. 20, T. 145 N., R. 63 W.	end moraine	43	33	24
SW corner sec. 34, T. 145 N., R. 63 W.	end moraine	40	34	26
SE corner sec. 34, T. 145 N., R. 62 W.	ground moraine	37	39	24
West side sec. 15, T. 145 N., R. 62 W.	ground moraine	13	73	13
SW side sec. 6, T. 145 N., R. 61 W.	ground moraine	44	34	21
SE corner sec. 11, T. 145 N., R. 63 W.	end moraine	30	30	40
SW corner sec. 23, T. 146 N., R. 63 W.	ground moraine	31	44	25
Center North side sec. 2, T. 146 N., R. 63 W.	ground moraine	46	26	28
SW corner sec. 31, T. 147 N., R. 63 W.	ground moraine	53	25	22
SW corner sec. 20, T. 147 N., R. 63 W.	ground moraine	53	22	25
NE corner sec. 26, T. 147 N., R. 62 W.	ground moraine	35	36	29
NE corner sec. 9, T. 146 N., R. 62 W.	ground moraine	28	27	45
NW corner sec. 26, T. 146 N., R. 62 W.	ground moraine	39	36	25

Average amounts of sand, silt, and clay in till of Kensal drift:

39      35      26

Average ratio of sand, silt, and clay is 8:7:5.

## II. Grace City Drift

NE corner sec. 31, T. 149 N., R. 67 W.	ground moraine	36	38	26
NE corner sec. 20, T. 148 N., R. 67 W.	ground moraine	38	37	25
NE corner sec. 8, T. 147 N., R. 67 W.	ground moraine	42	31	27
North side sec. 12, T. 147 N., R. 67 W.	ground moraine	35	23	42
NW corner sec. 33, T. 147 N., R. 67 W.	ground moraine	49	33	18
South side sec. 25, T. 147 N., R. 67 W.	ground moraine	45	35	20
NW corner sec. 30, T. 146 N., R. 67 W.	ground moraine	21	52	27
SW corner sec. 24, T. 146 N., R. 67 W.	ground moraine	50	29	21
East side sec. 12, T. 145 N., R. 67 W.	ground moraine	40	37	23
North side sec. 25, T. 145 N., R. 67 W.	ground moraine	44	28	27
SE corner sec. 33, T. 145 N., R. 66 W.	ground moraine	44	25	30
SW side sec. 25, T. 145 N., R. 66 W.	ground moraine	39	49	12
SE corner sec. 27, T. 146 N., R. 66 W.	ground moraine	44	38	18
NW corner sec. 11, T. 147 N., R. 66 W.	ground moraine	45	40	15
SW corner sec. 25, T. 148 N., R. 66 W.	ground moraine	26	56	18
SW corner sec. 8, T. 148 N., R. 66 W.	ground moraine	35	39	26
SE corner sec. 10, T. 149 N., R. 66 W.	ground moraine	27	55	18
SW corner sec. 11, T. 148 N., R. 65 W.	ground moraine	45	41	24
SE corner sec. 25, T. 148 N., R. 65 W.	ground moraine	34	34	32
SW side sec. 8, T. 147 N., R. 65 W.	ground moraine	61	22	17
NW corner sec. 23, T. 147 N., R. 65 W.	ground moraine	54	25	21
South side sec. 25, T. 147 N., R. 65 W.	end moraine	35	29	36
NE corner sec. 32, T. 147 N., R. 65 W.	ground moraine	45	31	23
NW corner sec. 21, T. 146 N., R. 65 W.	ground moraine	37	39	24
SE corner sec. 24, T. 146 N., R. 65 W.	ground moraine	35	39	26
SE corner sec. 1, T. 145 N., R. 65 W.	end moraine	40	33	27
NE corner sec. 7, T. 145 N., R. 65 W.	ground moraine	38	35	27
SW corner sec. 16, T. 145 N., R. 65 W.	ground moraine	38	48	14
Center East side sec. 36, T. 145 N., R. 65 W.	ground moraine	27	52	21
Center South side sec. 32, T. 145 N., R. 64 W.	end moraine	36	34	30
Center sec. 21, T. 145 N., R. 64 W.	end moraine	38	29	33
Center East side sec. 21, T. 145 N., R. 64 W.	end moraine	43	34	23
Center sec. 22, T. 145 N., R. 64 W.	end moraine	45	30	25
SE side sec. 3, T. 145 N., R. 64 W.	end moraine	53	32	15
SW corner sec. 3, T. 146 N., R. 64 W.	end moraine	57	20	23
SW side sec. 28, T. 147 N., R. 64 W.	ground moraine	48	28	24
NE corner sec. 15, T. 147 N., R. 64 W.	ground moraine	47	29	24
SW corner sec. 12, T. 148 N., R. 64 W.	ground moraine	48	30	22
SW corner sec. 4, T. 148 N., R. 64 W.	ground moraine	38	32	30

Average amounts of sand, silt, and clay in tills of Grace City drift:

41      35      24

Average ratio of sand, silt, and clay is 9:7:5.

## III. Heimdal Drift

East side sec. 6, T. 150 N., R. 67 W.	ground moraine	32	40	28
NW corner sec. 12, T. 150 N., R. 67 W.	ground moraine	27	58	15
NW corner sec. 20, T. 150 N., R. 67 W.	ground moraine	3	65	32
NE corner sec. 25, T. 150 N., R. 67 W.	end moraine	29	37	34
NE corner sec. 7, T. 149 N., R. 67 W.	end moraine	45	47	8
SE corner sec. 10, T. 149 N., R. 67 W.	end moraine	45	42	13
SW corner sec. 27, T. 150 N., R. 66 W.	end moraine	4	35	61
SW corner sec. 12, T. 150 N., R. 66 W.	end moraine	38	43	19
SW corner sec. 34, T. 151 N., R. 65 W.	end moraine	45	36	19

Average amounts of sand, silt, and clay in tills of Heimdal drift:

30      45      25

Average ratio of sand, silt, and clay is 6:9:5.

## IV. McHenry Drift

SW side sec. 6, T. 147 N., R. 62 W.	ground moraine	32	47	21
SW side sec. 1, T. 147 N., R. 62 W.	ground moraine	32	43	25
SW side sec. 21, T. 148 N., R. 63 W.	end moraine	34	32	34
NW corner sec. 20, T. 148 N., R. 63 W.	end moraine	64	24	12
SE corner sec. 3, T. 148 N., R. 63 W.	end moraine	47	30	23
SE side sec. 17, T. 148 N., R. 62 W.	end moraine	47	43	10
SE side sec. 11, T. 148 N., R. 62 W.	end moraine	28	62	10
SW corner sec. 34, T. 149 N., R. 62 W.	end moraine	50	38	12
NW corner sec. 31, T. 149 N., R. 62 W.	end moraine	45	42	12
SE corner sec. 34, T. 149 N., R. 63 W.	end moraine	14	54	31
SE corner sec. 29, T. 149 N., R. 63 W.	end moraine	61	29	10
Center South side sec. 30, T. 149 N., R. 63 W.	end moraine	42	39	19
SE side sec. 24, T. 149 N., R. 64 W.	end moraine	19	43	38
SW corner sec. 11, T. 149 N., R. 64 W.	end moraine	38	43	19
ENE side sec. 11, T. 149 N., R. 63 W.	end moraine	49	42	9
SE side sec. 18, T. 149 N., R. 62 W.	end moraine	42	36	22
SE corner sec. 23, T. 149 N., R. 62 W.	ground moraine	42	42	16
SSW corner sec. 6, T. 149 N., R. 61 W.	ground moraine	28	37	35
SE corner sec. 33, T. 150 N., R. 62 W.	ground moraine	44	45	11
E side sec. 31, T. 150 N., R. 62 W.	end moraine	46	34	20
NW corner sec. 25, T. 150 N., R. 63 W.	end moraine	60	26	14
Center South side sec. 3, T. 150 N., R. 63 W.	ground moraine	49	38	13
SW corner sec. 8, T. 150 N., R. 63 W.	end moraine	20	50	30
NE corner sec. 36, T. 151 N., R. 64 W.	end moraine	54	35	11
NE corner sec. 11, T. 150 N., R. 64 W.	end moraine	60	29	11
NW corner sec. 21, T. 150 N., R. 64 W.	end moraine	4	74	22
SE corner sec. 20, T. 150 N., R. 64 W.	end moraine	30	51	19

Average amount of sand, silt, and clay in tills of McHenry drift:

41      41      18

Average ratio of sand, silt, and clay is 2:2:1.

## V. Silt samples taken from Proglacial Lake Deposits

South side sec. 3, T. 149 N., R. 64 W.		2	66	32

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TABLE 3

Major Boulder Types on the Surface in Eddy and Foster Counties.

## Part I. Kensal Drift

Location of Sample	Number in Sample	Percentages of each rock type		
		Igneous	Metamorphic	Carbonate
West side sec. 23, T. 145 N., R. 64 W.	125	36.6	28.5	35.0
SW corner sec. 20, T. 145 N., R. 63 W.	117	47.8	19.6	32.5
Center South side sec. 2, T. 145 N., R. 64 W.	122	67.2	27.7	5.0
NE side sec. 26, T. 146 N., R. 64 W.	123	58.0	23.5	18.5
NE corner sec. 30, T. 146 N., R. 63 W.	120	37.6	52.1	10.2
NE corner sec. 29, T. 147 N., R. 63 W.	121	57.8	30.6	11.6
Center North side sec. 28, T. 147 N., R. 63 W.	102	57.4	33.7	8.9
Average Percentages		51.8	30.8	17.2

## Part II. Grace City Drift

SW corner sec. 5, T. 147 N., R. 63 W.	126	77.4	18.5	4.0
NW corner sec. 2, T. 146 N., R. 64 W.	141	62.7	32.6	5.7
Center North side sec. 29, T. 147 N., R. 64 W.	111	81.0	9.9	9.0
North side sec. 32, T. 147 N., R. 64 W.	108	72.4	20.9	6.7
NE corner sec. 9, T. 146 N., R. 64 W.	123	76.8	15.7	7.4
NW corner sec. 10, T. 145 N., R. 64 W.	122	77.9	22.1	None
Center North side sec. 21, T. 145 N., R. 64 W.	111	49.6	34.8	15.6
Center sec. 22, T. 145 N., R. 64 W.	99	66.0	24.8	9.3
East side sec. 21, T. 145 N., R. 64 W.	104	66.6	27.4	6.9
Center South side sec. 29, T. 145 N., R. 64 W.	131	77.9	17.6	4.6
Average Percentages		70.8	22.4	6.9

## Part III. Heimdal Drift

SW corner sec. 30, T. 150 N., R. 67 W.	109	60.6	36.7	2.8
SW corner sec. 1, T. 149 N., R. 67 W.	109	74.2	12.8	12.8
NE corner sec. 34, T. 150 N., R. 66 W.	111	69.4	25.2	5.4
SW corner sec. 4, T. 150 N., R. 65 W.	110	70.9	20.9	8.2
Average Percentages		68.8	23.9	7.3

## Part IV. McHenry Drift

SE corner sec. 20, T. 150 N., R. 64 W.	124	49.6	43.2	7.3
Center South side sec. 16, T. 150 N., R. 64 W.	125	55.9	34.8	9.3
SE corner sec. 2, T. 150 N., R. 64 W.	124	42.5	33.3	24.2
SW 1/4 sec. 13, T. 150 N., R. 64 W.	127	49.6	33.8	16.5
SW 1/4 sec. 7, T. 150 N., R. 63 W.	143	47.2	38.7	14.1
SE corner sec. 28, T. 150 N., R. 63 W.	133	53.4	23.3	23.3
SW corner sec. 13, T. 149 N., R. 64 W.	129	51.6	37.9	10.5
SE corner sec. 3, T. 148 N., R. 63 W.	122	57.4	40.8	1.7
NE corner sec. 31, T. 149 N., R. 62 W.	144	48.6	29.2	22.2
SE side sec. 5, T. 149 N., R. 62 W.	131	53.1	23.1	23.9
SE corner sec. 36, T. 150 N., R. 62 W.	103	67.0	21.4	11.6
SE corner sec. 1, T. 148 N., R. 62 W.	144	52.4	34.9	12.6
SE corner sec. 22, T. 148 N., R. 62 W.	133	48.1	40.4	11.5
Center East side sec. 18, T. 147 N., R. 62 W.	107	58.0	24.0	18.0
Center East side sec. 22, T. 147 N., R. 63 W.	131	60.4	35.6	3.9
SW corner sec. 15, T. 147 N., R. 63 W.	109	59.3	30.6	10.2
NW corner sec. 10, T. 147 N., R. 63 W.	104	52.1	36.7	11.2
Average Percentages		53.2	32.4	14.2

## Part V. Drift on the Missouri Coteau

Center East side sec. 31, T. 145 N., R. 67 W.	134	59.1	22.0	18.9
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TABLE 4

Major Pebble Types in Surficial Till of Eddy and Foster Counties.

## Part I. Kensal Drift

Location of Sample	Number in Sample	Percentages of each rock type		
		Igneous & Metamorphic	Carbonate	Local Bedrock
SW side sec. 24, T. 146 N., R. 64 W.	128	55.5	28.9	15.6
SW side sec. 36, T. 146 N., R. 64 W.	122	44.2	36.9	18.8
SW corner sec. 24, T. 145 N., R. 64 W.	97	26.8	38.2	35.0
West side sec. 23, T. 145 N., R. 64 W.	98	21.4	45.9	32.6
NW corner sec. 6, T. 144 N., R. 63 W.	139	30.2	48.2	21.6
SW corner sec. 8, T. 145 N., R. 63 W.	129	40.3	39.5	20.2
SW corner sec. 20, T. 145 N., R. 63 W.	120	30.8	61.6	7.5
SW corner sec. 15, T. 145 N., R. 62 W.	148	21.7	58.8	19.6
SW side sec. 10, T. 146 N., R. 62 W.	118	40.6	57.6	0.8
SW corner sec. 10, T. 146 N., R. 63 W.	124	62.1	35.5	2.4
Average Percentages		37.4	45.1	17.1

## Part II. Grace City Drift

SE side sec. 33, T. 149 N., R. 67 W.	118	51.7	37.3	11.0
NW 1/4 sec. 5, T. 149 N., R. 65 W.	119	61.3	32.8	5.9
North side sec. 6, T. 148 N., R. 64 W.	123	65.1	30.9	4.1
North side sec. 9, T. 148 N., R. 66 W.	127	51.2	40.9	7.9
NE side sec. 20, T. 148 N., R. 67 W.	133	57.2	34.6	8.3
South side sec. 25, T. 148 N., R. 66 W.	110	48.6	40.3	11.0
NW corner sec. 30, T. 148 N., R. 64 W.	120	80.7	4.2	15.0
SW corner sec. 19, T. 147 N., R. 66 W.	120	64.2	33.3	2.5
Center South side sec. 25, T. 147 N., R. 65 W.	121	57.8	34.7	7.4
SW corner sec. 3, T. 146 N., R. 64 W.	146	55.5	34.2	10.3
South side sec. 21, T. 146 N., R. 65 W.	126	55.5	37.3	7.1
South side sec. 21, T. 146 N., R. 66 W.	128	61.7	21.1	17.2
NW corner sec. 28, T. 146 N., R. 67 W.	122	36.9	54.9	8.2
South side sec. 24, T. 145 N., R. 66 W.	107	54.7	40.6	4.7
North side sec. 29, T. 145 N., R. 64 W.	102	56.9	37.2	5.9
Center sec. 21, T. 145 N., R. 64 W.	107	45.8	37.4	16.8
West side sec. 22, T. 145 N., R. 64 W.	80	42.6	47.5	10.0
Center sec. 22, T. 145 N., R. 64 W.	100	62.0	27.0	11.0
Average Percentages		56.1	34.8	9.1

## Part III. Heimdal Drift

SW side sec. 6, T. 150 N., R. 67 W.	119	47.9	48.7	3.4
NE corner sec. 12, T. 150 N., R. 67 W.	111	49.6	42.3	8.1
NW side sec. 34, T. 151 N., R. 66 W.	130	26.2	69.2	4.6
SW corner sec. 30, T. 150 N., R. 67 W.	129	41.1	53.4	5.4
SW corner sec. 1, T. 149 N., R. 67 W.	133	36.8	58.6	4.5
NE side sec. 34, T. 150 N., R. 66 W.	122	47.6	50.0	2.5
Center South side sec. 4, T. 150 N., R. 65 W.	126	40.4	53.1	6.4
Average Percentages		41.4	53.7	5.0

## Part IV. McHenry Drift

SE corner sec. 20, T. 150 N., R. 64 W.	109	67.9	22.0	10.1
East side sec. 16, T. 150 N., R. 64 W.	141	52.5	44.0	3.5
SW side sec. 2, T. 150 N., R. 64 W.	128	58.6	28.9	12.5
East side sec. 18, T. 150 N., R. 63 W.	134	23.3	51.9	24.8
SE side sec. 28, T. 150 N., R. 63 W.	155	29.7	36.1	34.2
Center North side sec. 14, T. 149 N., R. 64 W.	155	65.6	29.2	5.2
NW corner sec. 24, T. 149 N., R. 64 W.	132	46.3	48.4	5.3
SE corner sec. 24, T. 149 N., R. 64 W.	141	77.4	17.7	5.0
SW corner sec. 4, T. 149 N., R. 62 W.	135	40.0	42.2	17.8
SE corner sec. 36, T. 150 N., R. 62 W.	116	50.0	48.2	1.7
SE corner sec. 3, T. 148 N., R. 63 W.	136	53.7	25.7	20.6
NE corner sec. 5, T. 148 N., R. 62 W.	108	28.7	62.9	8.3
SE corner sec. 22, T. 148 N., R. 62 W.	121	70.2	28.9	0.8
NW corner sec. 29, T. 148 N., R. 63 W.	127	60.6	22.8	16.5
NW corner sec. 10, T. 147 N., R. 63 W.	129	59.7	32.5	7.8
NW side sec. 12, T. 147 N., R. 63 W.	137	41.6	47.4	11.0
Center East side sec. 18, T. 147 N., R. 62 W.	112	49.1	41.1	9.8
SE side sec. 16, T. 147 N., R. 62 W.	120	49.2	39.2	11.7
Center East side sec. 8, T. 147 N., R. 61 W.	142	43.6	36.6	19.7
Average Percentages		50.8	37.2	11.9

## Part V. Drift on the Missouri Coteau

West side sec. 31, T. 145 N., R. 67 W.	110	30.0	62.6	7.3
SE corner sec. 30, T. 145 N., R. 67 W.	130	16.1	60.0	23.8
Average Percentages		23.1	61.3	15.5

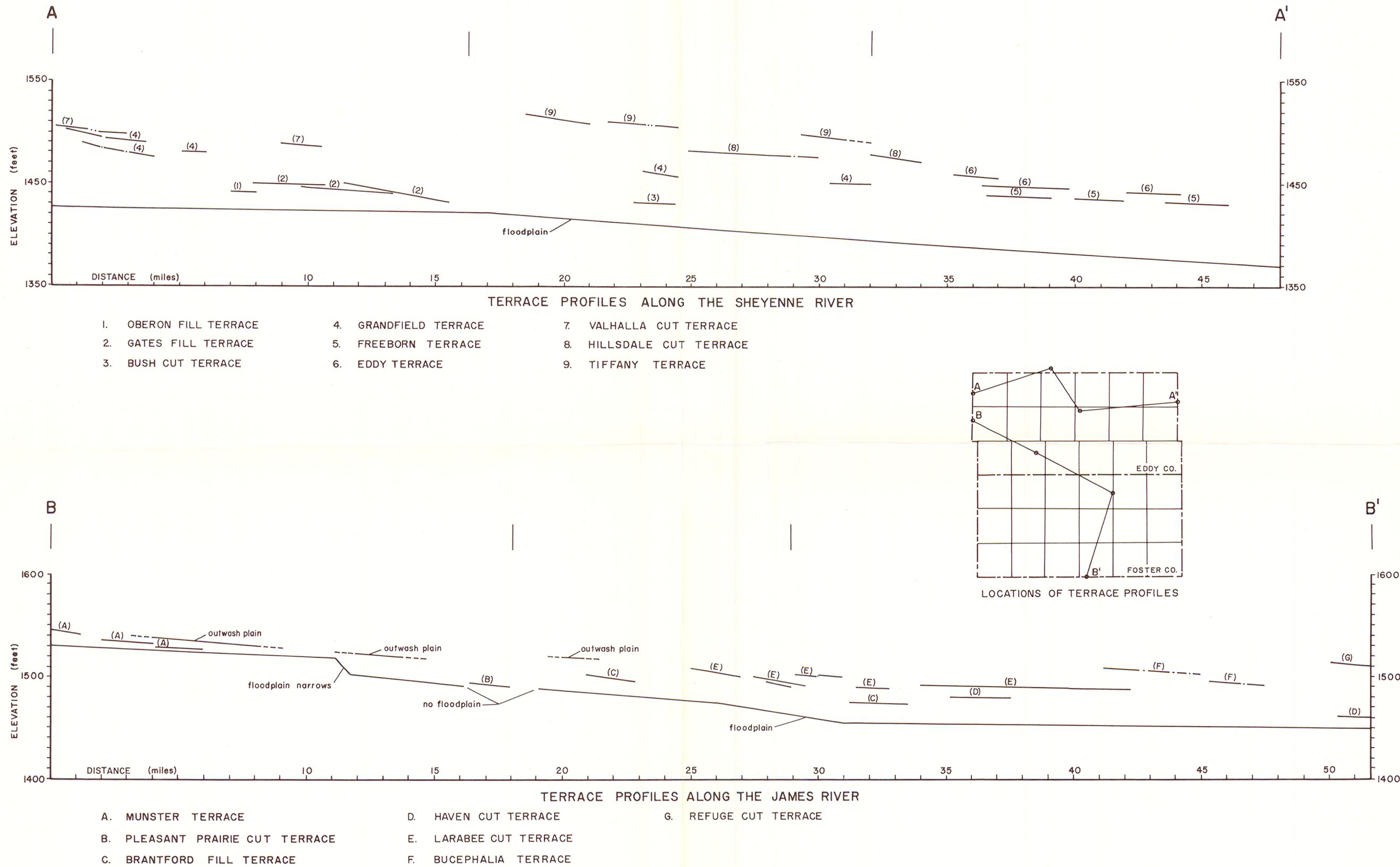


PLATE 3. Terrace profiles along the Sheyenne and James rivers.

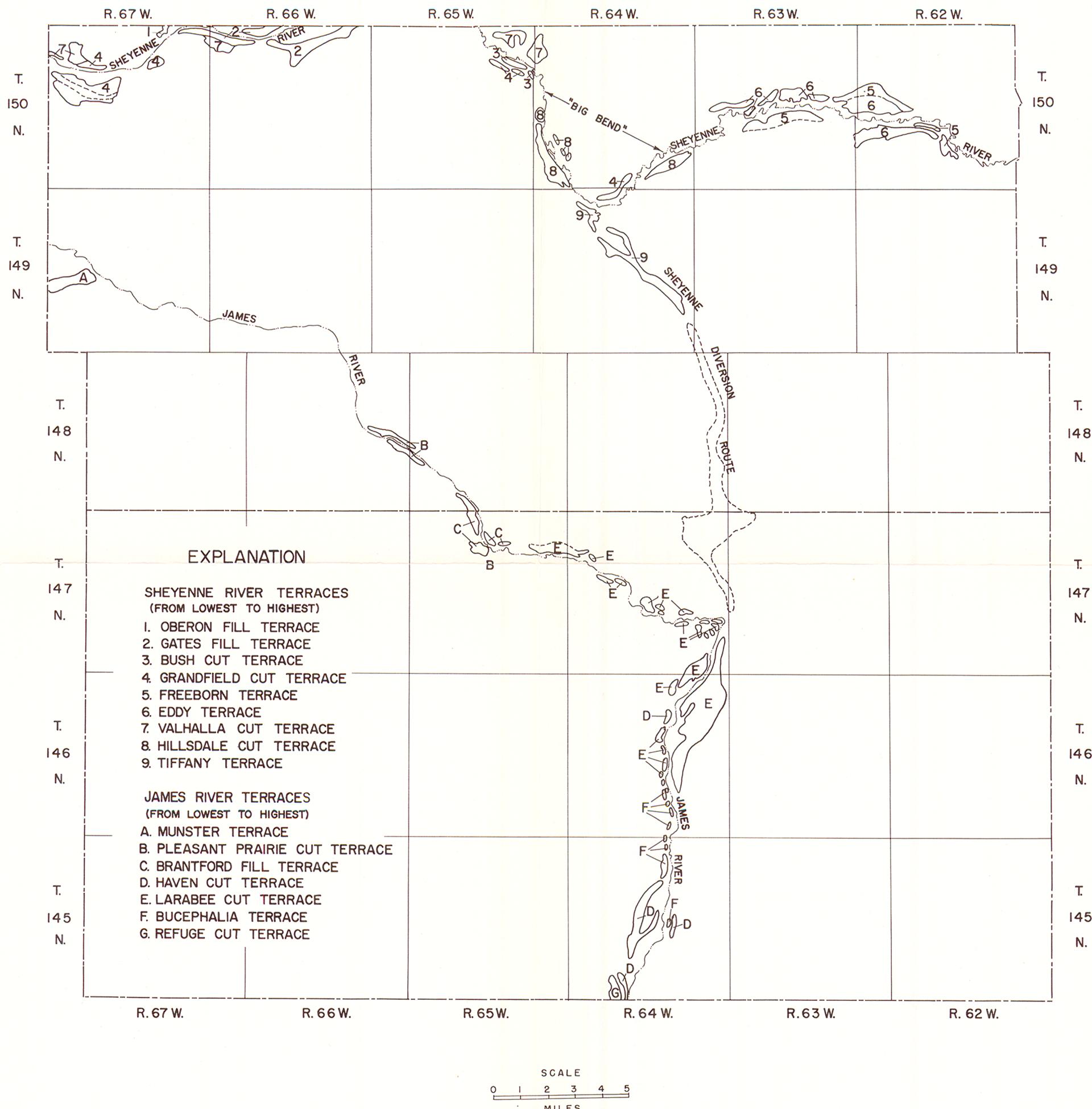


PLATE 4. Terrace map of Sheyenne and James rivers.

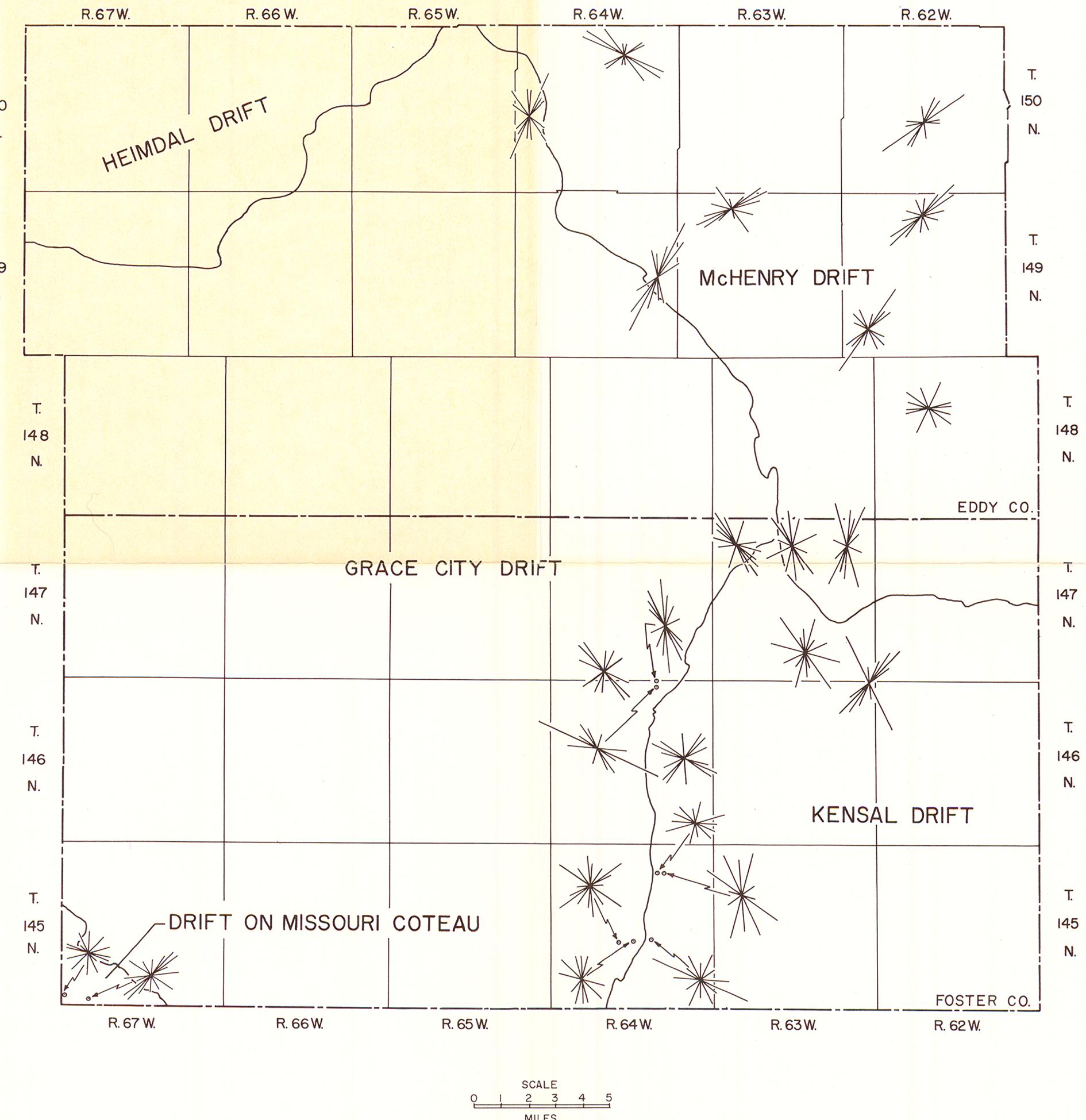


PLATE 5. Rose diagrams showing pebble orientation in till.

# GEOLOGIC CROSS-SECTIONS OF EDDY AND FOSTER COUNTIES, NORTH DAKOTA

## EXPLANATION

TILL, UNDIFFERENTIATED		OUTWASH, PRIMARY SAND SIZE	
TILL, COLLAPSED AND WASHED IN CROSS-SECTIONS A, B, AND C KENSAL TILL IN CROSS-SECTION F		OUTWASH, PRIMARY GRAVEL SIZE	
Kpsh		LAKE DEPOSITS, PRIMARY SILTS AND CLAYS	

