

TABLE 4.--Abundance of selected major and minor elements and eU in outcrop samples of a lignite and of various carbonaceous rocks in the Dengate and Glen Ullin quadrangles, Morton County, N. Dak.

[Samples with numbers beginning with G are from the Glen Ullin quadrangle; the rest are from the Dengate quadrangle. Percent ash determined gravimetrically and eU determined by Beta Gamma scaler by E. J. Fennelly. Semiquantitative spectrographic analyses by L. A. Bradley. Results of the spectrographic analyses are based on their identity with geometric brackets whose boundaries are 1.2, 0.83, 0.56, 0.38, 0.26, 0.18, 0.12, and so forth, and are reported arbitrarily as midpoints of these brackets, 1., 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, respectively. The precision of a reported value is approximately plus or minus one bracket at 68-percent, or two brackets at 95-percent confidence. Approximate visual lower limits of detection for Ag is .00005; B .002; Be .0001; Co .0003; La .003; Mo .0003; Nb .001; Ni .0005; Pb .001; Sc .0005; Sn .001; V .0007; Y .001; Zn .02; Zr .001; Ce .013; Ga .0005; Ge .001; Li .005; Yb .0001; Nd .007. Figures in percent by weight of sample except for those* for DC-1 (ash) which are in percent by weight of ash of the sample. G, greater than 10 percent; L, detected but below limit of determination or below value shown; N, not detected; --, not looked for]

Field No.	Location	Sample description	Fort Union Formation Member	USGS Lab. No.	Ash	eU	Al	Fe	Mg	Ca	Ti	Mn	Ag	B	Ba	Be	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sc	Sn	Sr	V	Y	Zn	Zr	Ce	Ga	Ge	Li	Yb	Nd
DC-1	Near center N½ sec. 13, T. 139 N., R. 88 W.	Selected unweathered sample from hard layer of previtrain and attrital material in Richter lignite bed.	Sentinel Butte	D139944	1.7	0.002	0.02	0.15	0.03	0.07	0.0015	.0002	N	.007	.03	N	N	.0003	.0002	N	N	L	.0007	N	N	N	.0007	N	N	N	N	N	N	N	N	N	-
DC-1 (ash)	Near center N½ sec. 13, T. 139 N., R. 88 W.	Ash of sample DC-1.	do.	D139944	-	-	*7.0	*0.5	*5.0	*7.0	*0.2	*.07	*.0007	*.7	*.3	*N	*.003	*.015	*.03	*.007	*.003	*L.002	*.07	*.002	*.002	*N	*.2	*.01	*.007	*N	*.01	*N	*.005	*N	*.03	*.0005	*N
GU-15	SW¼SE¼ sec. 32, T. 139 N., R. 88 W.	Carbonaceous silt-shale, clayey, dark-brown to brownish-black; from interval 2½-4½ ft above Tavis Creek lignite bed (Barclay, 1970, strat. sec. 34, pl. 3).	Tongue River	D139945	86.7	0.003	7.0	2.0	1.0	0.3	0.3	.007	N	.01	.05	.00015	.0007	.007	.002	.007	N	.001	.003	.0015	.0015	N	.03	.007	.003	N	.015	N	.002	N	N	.0003	.007
GUP-4	SW¼SE¼ sec. 32, T. 139 N., R. 88 W.	From same interval as GU-15.	do.	D139940	87.3	0.003	7.0	1.5	0.7	0.2	0.3	.007	N	.01	.07	.0001	.0007	.007	.002	.007	N	.001	.0015	.0015	.001	N	.03	.007	.003	N	.015	.015	.002	N	N	.0003	.01
GU-16	SW¼SE¼ sec. 32, T. 139 N., R. 88 W.	Carbonaceous mud-shale, flaky, brownish-black; from interval 4½-6 ft above Tavis Creek lignite bed (Barclay, 1970, strat. sec. 34, pl. 3).	do.	D139946	67.7	0.003	5.0	3.0	0.7	0.7	0.2	.01	N	.007	.05	.0002	.0015	.007	.005	.005	.0003	L	.007	.0015	.0015	N	.03	.01	.003	N	.015	N	.0015	N	N	.0002	N
GU-49	NE¼NW¼NE¼ sec. 5, T. 138 N., R. 88 W.	Carbonaceous silt-shale, clayey, slightly sandy, grayish-brown; contains carbonized plant fragments; from bed about 11 ft above base of Sentinel Butte Member (Barclay, 1970, strat. sec. 33, pl. 3).	Sentinel Butte	D139947	80.3	0.005	7.0	3.0	1.0	0.15	0.3	.015	N	.007	.1	.00015	.0007	.01	.015	.003	.0007	L	.003	.002	.0015	N	.03	.015	.002	N	.007	N	.003	N	N	.0002	L
GU-56	Near center W½W½ sec. 17, T. 138 N., R. 88 W.	Carbonaceous silt-shale, clayey, slightly sandy, grayish-brown; contains carbonized plant fragments; slickensides; about 21 ft above ws bed (Barclay, 1970, strat. sec. 12, pl. 2).	do.	D139948	83.7	0.004	7.0	1.0	0.7	0.07	0.2	.01	N	.015	.03	N	N	.007	.01	.003	N	L	.0007	.002	.001	N	.015	.015	L	N	.007	N	.003	N	N	.0001	N
GU-58	Near center W½W½ sec. 17, T. 138 N., R. 88 W.	Carbonaceous silt-shale, clayey, irregularly brown and blackish brown, lignitic; 16 ft above ws bed (Barclay, 1970, strat. sec. 12, pl. 2).	do.	D139932	79.7	0.002	5.0	1.0	0.5	0.15	0.3	.01	N	.01	.05	.00015	.001	.007	.007	.01	L	.001	.003	.002	.0015	N	.07	.007	.003	N	.002	.02	.002	N	N	.0003	.01
GU-67	Near center W½W½ sec. 17, T. 138 N., R. 88 W.	Carbonaceous mud-shale, blackish-brown; ws bed (Barclay, 1970, strat. sec. 12, pl. 2).	do.	D139933	86.3	0.002	7.0	3.0	0.7	0.15	0.3	.007	N	.007	.07	.0002	.0007	.007	.005	.005	.0003	.001	.003	.002	.0015	N	.03	.01	.003	N	.015	.015	.003	N	N	.0003	.007
GU-69	Near center W½W½ sec. 17, T. 138 N., R. 88 W.	Carbonaceous mud-shale, light-grayish-brown; contains carbonized plant fragments; about 57½ ft below ws bed (Barclay, 1970, strat. sec. 12, pl. 2).	do.	D139934	89.7	0.002	7.0	3.0	0.7	0.15	0.3	.007	N	.01	.07	.0002	.0015	.007	.005	.005	.0005	.001	.003	.002	.0015	N	.03	.015	.003	N	.015	.015	.003	N	N	.0003	.007
GU-70	Near center W½W½ sec. 17, T. 138 N., R. 88 W.	Carbonaceous silt-shale, clayey, slightly sandy, very light brownish gray; contains carbonized plant fragments; 55 ft below ws bed (Barclay, 1970, strat. sec. 12, pl. 2).	do.	D139935	93.7	0.002	7.0	3.0	0.7	0.15	0.3	.007	N	.01	.07	.00015	.001	.007	.007	.005	N	.001	.003	.0015	.0015	N	.03	.015	.002	N	.015	.015	.003	N	N	.0003	.007
GU-86a	Near center W½ sec. 22, T. 138 N., R. 88 W.	Sandstone, ferruginous; contains fragments of lignite; overlies Spring Valley lignite bed.	do.	D139936	69.7	0.002	3.0	7.0	0.15	1.5	0.1	.003	N	.002	.07	N	N	.0015	.0015	N	.0007	L	.0005	.001	.0005	N	.03	.007	N	N	.005	N	.001	.001	N	.0001	--
GU-143	North of Big Muddy Creek in T. 139 N., R. 88 W. (exact location unknown)	Silicified carbonaceous shale; srl bed.	do.	D139939	96.3	0.001	0.15	0.07	0.05	0.2	0.003	.0003	N	.003	.07	.00015	N	.0002	.001	N	N	L	.001	N	N	N	.0015	N	L	N	.0015	N	N	N	N	.0001	--
✓ D-9a	NW¼SE¼NW¼ sec. 7, T. 138 N., R. 87 W.	Silicified carbonaceous shale near base of Richter lignite bed; srl bed(?).	do.	D139927	97.3	<0.001	0.3	0.15	0.07	0.2	0.005	.003	N	.002	.03	N	N	.00015	.005	N	N	L	.003	N	N	N	.0015	N	N	N	N	N	N	N	N	L	--
✓ D-9b	NW¼SE¼NW¼ sec. 7, T. 138 N., R. 87 W.	do.	do.	D139928	87.3	<0.001	0.1	0.1	0.1	0.7	0.002	.0002	N	.003	.07	N	.0005	.0001	.002	N	N	L	.002	N	N	N	.007	N	L	N	N	N	N	N	N	L	--
D-14a	NW¼SE¼NW¼ sec. 7, T. 138 N., R. 87 W.	do.	do.	D139941	97.3	0.001	0.2	0.2	0.01	3.0	0.005	.0005	N	L	.007	N	N	.00015	.002	N	N	L	.0005	N	N	N	.01	N	N	N	N	N	N	N	N	N	--
D-14b	NW¼SE¼NW¼ sec. 7, T. 138 N., R. 87 W.	do.	do.	D139942	94.3	<0.001	0.1	0.05	0.03	1.5	0.0015	.007	N	L	.003	N	N	.0001	.001	N	N	L	.0015	N	N	N	.007	N	N	N	N	N	N	N	N	N	--
D-14c	NW¼SE¼NW¼ sec. 7, T. 138 N., R. 87 W.	do.	do.	D139943	97.7	<0.001	0.3	0.3	0.03	0.2	0.015	.007	N	.003	.05	N	N	.0003	.0015	N	N	L	.0007	N	N	N	.0015	N	N	N	N	N	N	N	N	N	--
✓ D-12	Near center N½SE¼ sec. 8, T. 138 N., R. 87 W.	Silicified carbonaceous shale; srl bed.	do.	D139929	91.3	<0.001	0.15	0.2	0.1	0.3	0.003	.0005	N	.002	.015	N	N	.0001	.002	N	N	L	.0007	N	N	N	.003	N	L	N	N	N	N	.0015	N	L	--
D-13a	SW¼SW¼NE¼ sec. 8, T. 138 N., R. 87 W.	do.	do.	D139930	90.7	<0.001	0.03	0.1	0.15	0.3	0.002	.0007	N	.005	.01	N	N	.0001	.002	N	N	L	L	N	N	N	.002	N	N	N	N	N	N	N	N	L	--
D-13b	SW¼SW¼NE¼ sec. 8, T. 138 N., R. 87 W.	do.	do.	D139931	96.7	<0.001	0.05	0.15	0.15	0.2	0.0015	.0001	N	.003	.015	N	N	.0001	.002	N	N	L	L	N	N	N	.0015	N	N	N	N	N	N	N	N	N	--
GU-132	NE¼NE¼ sec. 18, T. 138 N., R. 88 W.	Siltstone, carbonaceous, slightly silicified, zeolitic; contains carbonized plant fragments.	do.	D139937	95.7	0.001	3.0	0.7	0.5	0.3	0.3	.005	N	.007	.03	N	.0005	.003	.002	.003	N	.001	.0015	.0015	.0007	N	.015	.003	.001	N	.015	N	.0015	N	N	.00015	N
GU-141b	NW¼SW¼ sec. 17, T. 138 N., R. 88 W.	Ganister float.	Sentinel Butte(?)	D139938	96.7	0.001	5.0	1.0	0.7	0.2	0.3	.007	N	.005	.1	N	.0007	.003	.002	.005	N	.001	.0015	.001	.0007	N	.015	.005	.002	N	.015	N	.001	N	N	.0002	N

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