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ANALYSES OF ROCK SAMPLES FROM THE HUNT FORK SHALE AND RELATED UPPER DEVONIAN ROCKS, PHILIP SMITH MOUNTAINS QUADRANGLE, ARCTIC ALASKA

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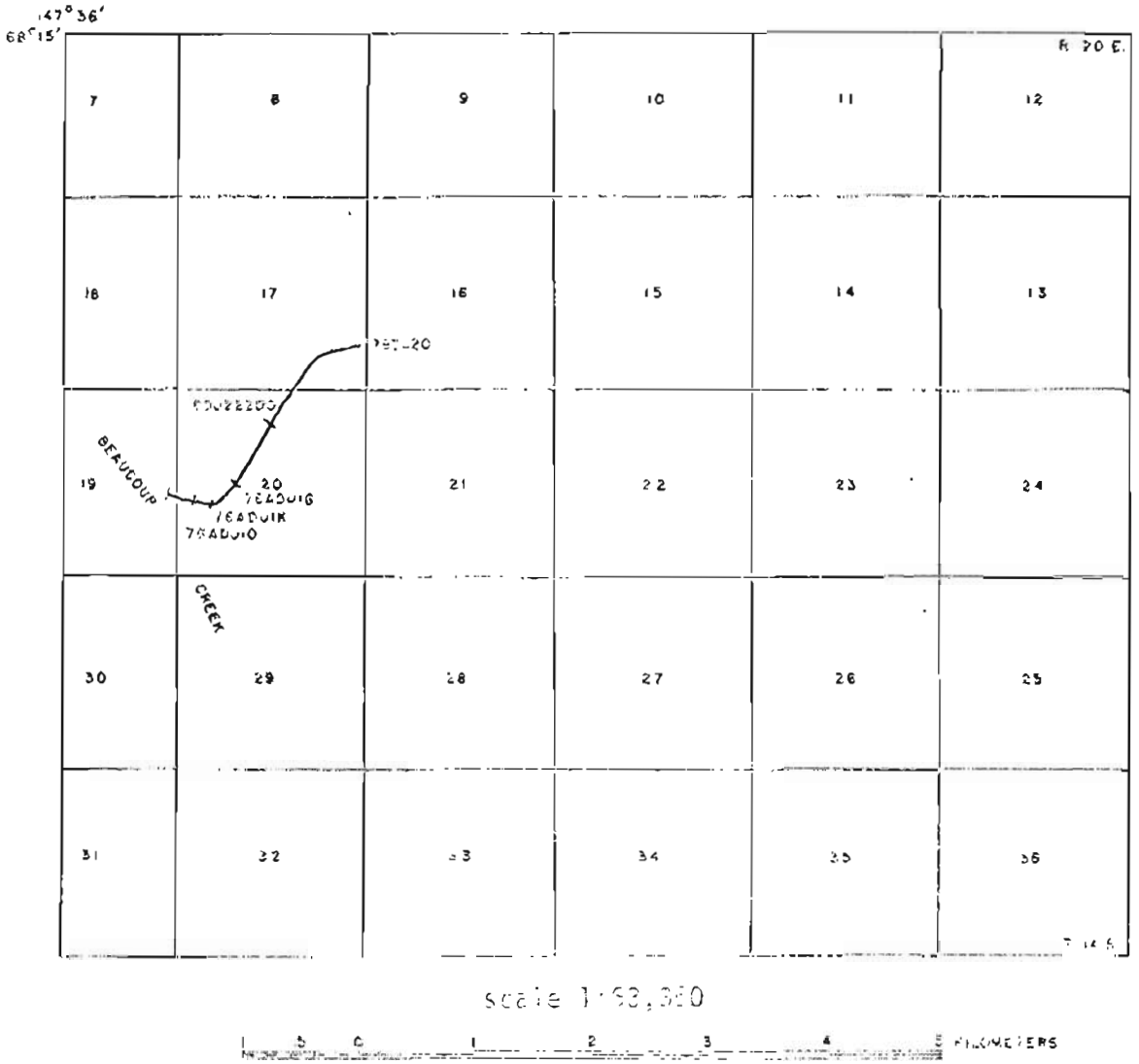
More than 1400 m of fine-grained clastic rocks and reefoid limestones constitute the lower part of an Upper Devonian transgressive-regressive cycle in the central Brooks Range, Alaska (Dutro and others, 1977). The Hunt Fork Shale and an underlying heterogeneous unit (unnamed) were measured and sampled on the east side of the upper Beaucoup Creek in the Philip Smith Mountains A-1 quadrangle (secs. 17, 19, and 20, T. 14 S., R. 20 E.) (Brosgé and others, 1977).

The Hunt Fork Shale, predominantly laminated, noncalcareous dark silt-shale, includes several fine-grained sandstones intervals and a few shelly limestone beds containing Frasnian brachiopods, molluscs, and corals. The partial measured section of Hunt Fork Shale, more than 700 m thick, contains at least five minor cycles, each of which grades upward from fine-grained sandstone through silt-shale to dark gray shale or mudstone. Two of these cycles contain thin limestone beds in their upper parts.

The Hunt Fork Shale sequence was measured from the top downwards to the contact with reefoid limestone that caps the unnamed unit. Channel samples of the darker shales were collected about every 15 m for subsequent chemical analysis. In addition, three dark shale intervals in the unnamed formation were similarly sampled (Fig. 1).



Philip Smith Mountains A-1 quadrangle, Arctic Alaska

Figure 1.— Map showing location of measured section; upper and lower sample sites of the Kent Fort Shale, 76Du20 and 6Du22200 respectfully; and three sample sites from the underlying unnamed formation, (sections 17, 19, and 20, T. 1- S., R. 20 E.).

A total of 48 rock samples was collected. Samples 76ADu1K, G, and O are from the unnamed formation, and the other 45 samples are from the Hunt Fork Shale; 76Du20 is the uppermost sample in the section of the Hunt Fork and 6Du22200 is the lowest.

The rock samples collected from the Hunt Fork Shale and the unnamed formation were crushed in a chipmunk crusher to approximately 6 mm and ground to minus-150-mesh (0.1 mm) on ceramic plates in a vertical pulverizer.

The prepared samples were analyzed for 30 elements using a six-step D.C.-arc semiquantitative emission spectrographic method described by Grimes and Marranzino (1968). Results were reported as the approximate midpoints of geometric brackets whose boundaries are: 0.082, 0.121, 0.177, 0.261, 0.383, 0.562, 0.825, etc. The spectrographic method provides repeatability within one reporting interval of the reported value approximately 83 percent of the time and within two reporting intervals of the reported value approximately 96 percent of the time (Motooka and Grimes, 1976).

Atomic-absorption spectroscopy was used to determine the concentration of zinc in the prepared samples. This method provides a precision of plus or minus 1 percent of the reported value (Ward and others, 1969).

Results of the rock analyses appear in table 1. Column 1 contains the sample field number; in samples 76Du20 through 6DU22200, the digits following the suffix 76DU2 or 6DU 2 indicate the stratigraphic position in feet from which the sample was taken in the measured section of Hunt Fork Shale. Latitude and longitude are expressed in degrees. Columns in which the element heading is preceded by an S contain element concentrations determined by emission spectroscopy. Atomic-absorption results for zinc appear in the last column under the heading AA-Zn-P. Results for all elements are reported in parts per million except iron, magnesium, calcium, and titanium, which are reported in percent.

An "N" in table 1 indicates that the element was not detected, and "<" indicates that the element was detected, but that the value was below the limit of detection.

The approximate visual lower limits of determination for the 30 elements analyzed by semiquantitative emission spectrography included in this report are as follows: for those elements reported in percent--iron and calcium, 0.05; titanium, 0.002; and magnesium, 0.02; for those elements reported in ppm--silver, 0.5; beryllium, 1; cobalt, copper, molybdenum, nickel, and scandium, 5; manganese, gold, boron, bismuth, chromium, lead, tin, vanadium, yttrium, and zirconium, 10; barium, cadmium, lanthanum, and niobium, 20; tungsten, 50; antimony and strontium, 100; and arsenic and zinc, 200. The lower limit of detection for zinc by atomic absorption is 5 ppm.

Table 1.--Analytical results for rock samples from the Hunt Fort Shale and related Upper Devonian rocks, Philip Smith Mountains A-1 quadrangle, Alaska.

Sample	LATITUDE	LONGITUDE	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-AS	S-AU	S-B	S-BA	S-BE	S-BI	S-CD
76ABD1K	68.2167	147.5667	15	5.0	3.0	1.0	700	N	N	N	100	700	1	N	N
76ABD1G	68.2167	147.5667	15	1.5	.5	1.0	1,000	N	N	N	100	700	3	N	N
76ABD10	68.2139	147.5792	15	7.0	10.0	.7	1,000	N	N	N	70	500	N	N	N
76B020	68.2250	147.5389	15	3.0	.3	1.0	1,000	N	N	N	100	700	2	N	N
76B0250	68.2250	147.5389	15	2.0	.2	.7	1,000	N	N	N	70	500	3	N	N
76B02100	68.2250	147.5389	15	3.0	.2	.7	2,000	N	N	N	70	500	2	N	N
76B02150	68.2250	147.5389	15	2.0	.2	1.0	1,500	N	N	N	100	500	2	N	N
76B02200	68.2250	147.5389	15	2.0	.2	.7	1,500	N	N	N	100	500	3	N	N
76B02250	68.2250	147.5389	15	2.0	.3	.7	1,500	N	N	N	100	500	3	N	N
76B02300	68.2250	147.5389	15	2.0	.3	.7	2,000	N	N	N	70	500	3	N	N
76B02350	68.2250	147.5389	10	1.5	.2	.7	1,500	N	N	N	70	500	3	N	N
76B02400	68.2250	147.5389	15	2.0	.2	1.0	2,000	N	N	N	70	500	3	N	N
76B02450	68.2250	147.5389	15	2.0	.2	1.0	1,500	N	N	N	100	500	3	N	N
76B02500	68.2250	147.5389	15	3.0	.2	.7	1,500	N	N	N	70	500	3	N	N
76B02550	68.2250	147.5389	15	3.0	.2	1.0	1,500	N	N	N	100	700	3	N	N
76B02600	68.2250	147.5389	15	2.0	.1	.7	1,000	N	N	N	70	500	2	N	N
76B02650	68.2250	147.5389	15	3.0	.2	1.0	1,500	N	N	N	70	500	2	N	N
76B02700	68.2250	147.5389	15	3.0	.2	1.0	2,000	N	N	N	100	700	2	N	N
76B02750	68.2250	147.5389	15	2.0	.2	.7	2,000	N	N	N	70	500	2	N	N
76B02800	68.2250	147.5389	15	3.0	.3	.7	1,500	N	N	N	70	500	2	N	N
76B02850	68.2250	147.5389	15	3.0	.3	1.0	1,500	N	N	N	70	500	2	N	N
76B02900	68.2250	147.5389	10	2.0	.2	.7	1,500	N	N	N	50	500	3	N	N
76B02950	68.2250	147.5389	15	3.0	.3	1.0	1,500	N	N	N	70	500	<1	N	N
6B021000	68.2222	147.5500	15	3.0	1.0	1.0	1,500	N	N	N	100	700	2	N	N
6B021050	68.2222	147.5500	15	3.0	.7	1.0	1,500	N	N	N	100	700	2	N	N
6B021100	68.2222	147.5500	15	2.0	.3	.7	1,000	N	N	N	70	500	2	N	N
6B021150	68.2222	147.5500	15	2.0	.5	1.0	1,000	N	N	N	70	500	2	N	N
6B021200	68.2222	147.5500	15	2.0	.2	.7	1,500	N	N	N	70	500	2	N	N
6B021250	68.2222	147.5500	15	3.0	.5	.7	1,500	N	N	N	70	500	2	N	N
6B021300	68.2222	147.5500	15	2.0	.2	.7	1,500	N	N	N	70	500	2	N	N
6B021350	68.2222	147.5500	5	1.5	.1	.5	1,500	N	N	N	50	500	3	N	N
6B021400	68.2222	147.5500	15	2.0	.2	.7	1,500	N	N	N	70	500	2	N	N
6B021450	68.2222	147.5500	10	1.5	.1	.7	1,000	N	N	N	70	500	3	N	N
6B021500	68.2222	147.5500	15	2.0	.2	1.0	1,500	N	N	N	100	700	2	N	N
6B021550	68.2222	147.5500	15	2.0	.5	.7	1,000	N	N	N	70	500	3	N	N
6B021600	68.2222	147.5500	10	1.5	.2	.7	1,000	N	N	N	70	500	3	N	N
6B021650	68.2222	147.5500	15	3.0	.3	1.0	1,500	N	N	N	100	500	2	N	N
6B021700	68.2222	147.5500	15	1.5	.5	.7	1,500	N	N	N	70	500	3	N	N
6B021750	68.2222	147.5500	15	1.5	.2	.7	1,500	N	N	N	70	500	3	N	N
6B021800	68.2222	147.5500	15	3.0	.7	1.0	1,500	N	N	N	70	500	2	N	N
6B021850	68.2222	147.5500	15	3.0	.1	1.0	1,000	N	N	N	70	500	2	N	N
6B021900	68.2222	147.5500	15	2.0	.1	.7	1,000	N	N	N	70	500	3	N	N
6B021950	68.2222	147.5500	15	3.0	.1	1.0	1,500	N	N	N	100	500	3	N	N
6B022000	68.2200	147.5556	10	2.0	.1	.7	1,500	N	N	N	70	500	3	N	N
6B022050	68.2200	147.5556	15	2.0	.2	1.0	1,500	N	N	N	100	500	2	N	N
6B022100	68.2200	147.5556	15	3.0	.1	.7	1,500	N	N	N	70	500	3	N	N
6B022150	68.2200	147.5556	15	2.0	.5	.7	2,000	N	N	N	70	500	3	N	N
6B022200	68.2200	147.5556	15	2.0	.2	.7	1,000	N	N	N	70	500	3	N	N

Table 1.--continued

Sample	S-CO	S-CR	S-CU	S-LA	S-MO	S-NB	S-NI	S-PB	S-SB	S-SC	S-SN	S-SR	S-V	S-W	S-Y	S-ZN	S-ZR	AA-ZN-P
760[illegible]K	70	700	300	30	N	N	200	30	N	30	N	100	500	N	50	200	500	120
760[illegible]16	20	200	150	100	N	N	150	30	N	30	N	100	500	N	50	N	500	150
760[illegible]10	50	300	200	20	N	N	150	30	N	30	N	150	500	N	30	N	150	120
760[illegible]0	50	300	300	70	N	N	150	30	N	30	N	100	500	N	50	200	500	120
760[illegible]250	15	150	70	70	N	N	100	20	N	30	N	100	300	N	50	200	300	120
760[illegible]2100	100	300	100	70	N	N	150	50	N	30	N	100	500	N	50	300	300	120
760[illegible]2150	50	300	100	100	N	N	150	30	N	30	N	100	500	N	50	200	300	120
760[illegible]2200	50	150	100	70	N	N	100	50	N	30	N	100	300	N	50	300	300	120
760[illegible]2250	20	200	70	70	N	N	100	30	N	30	N	100	300	N	50	300	300	120
760[illegible]2300	30	300	100	70	N	N	150	30	N	30	N	100	300	N	50	300	300	120
760[illegible]2350	15	150	70	50	N	N	70	20	N	20	N	100	200	N	30	200	200	120
760[illegible]2400	30	200	200	70	N	N	150	30	N	30	N	100	500	N	50	300	300	120
760[illegible]2450	30	300	200	70	N	N	150	30	N	30	N	100	500	N	50	300	300	120
760[illegible]2500	15	150	200	50	N	N	100	50	N	20	N	100	300	N	30	200	150	120
760[illegible]2550	70	300	300	70	N	N	150	30	N	30	N	100	500	N	70	200	500	120
760[illegible]2600	15	300	70	70	N	N	100	20	N	30	N	100	300	N	50	300	200	130
760[illegible]2650	50	300	100	70	N	N	150	30	N	30	N	100	500	N	50	300	300	120
760[illegible]2700	70	500	150	100	N	N	200	50	N	30	N	100	500	N	50	200	500	120
760[illegible]2750	30	200	100	70	N	N	100	30	N	30	N	100	500	N	70	300	300	130
760[illegible]2800	20	500	100	70	N	N	100	30	N	30	N	100	200	N	50	200	300	110
760[illegible]2850	15	300	100	70	N	N	100	30	N	30	N	100	300	N	50	300	300	120
760[illegible]2900	15	200	70	70	N	N	70	20	N	30	N	100	200	N	50	200	300	120
760[illegible]2950	20	300	100	70	N	N	150	30	N	30	N	100	500	N	50	300	300	130
760[illegible]3000	50	300	150	50	N	N	150	30	N	30	N	100	500	N	30	200	200	120
760[illegible]3050	50	300	150	50	N	N	150	30	N	30	N	100	500	N	50	200	200	130
760[illegible]3100	15	200	100	70	N	N	100	15	N	20	N	100	200	N	30	200	200	120
760[illegible]3150	15	200	100	70	N	N	100	20	N	20	N	100	300	N	50	200	500	120
760[illegible]3200	15	150	100	70	N	N	100	20	N	20	N	100	300	N	50	200	500	100
760[illegible]3250	15	300	100	70	N	N	100	30	N	20	N	100	200	N	30	200	150	110
760[illegible]3300	15	150	70	70	N	N	100	20	N	20	N	100	300	N	30	200	300	110
760[illegible]3350	30	70	50	50	N	N	30	20	N	15	N	100	150	N	20	200	150	120
760[illegible]3400	20	200	70	70	N	N	150	30	N	30	N	100	500	N	50	200	200	120
760[illegible]3450	15	100	70	50	N	N	70	30	N	20	N	100	200	N	30	200	150	120
760[illegible]3500	30	300	100	70	N	N	150	30	N	30	N	100	500	N	50	200	500	120
760[illegible]3550	15	150	100	70	N	N	100	30	N	30	N	100	500	N	50	200	300	120
760[illegible]3600	15	150	100	70	N	N	100	20	N	20	N	100	500	N	30	200	200	110
760[illegible]3650	70	300	150	70	N	N	200	50	N	30	N	100	500	N	50	200	500	120
760[illegible]3700	15	200	100	70	N	N	150	30	N	20	N	100	500	N	50	200	300	110
760[illegible]3750	15	200	70	70	N	N	100	30	N	30	N	100	300	N	50	200	300	120
760[illegible]3800	70	300	150	70	N	N	200	50	N	30	N	100	500	N	50	200	500	130
760[illegible]3850	50	300	100	70	N	N	200	30	N	30	N	100	500	N	50	200	300	140
760[illegible]3900	20	150	70	70	N	N	100	30	N	30	N	100	500	N	30	200	200	140
760[illegible]3950	50	300	150	70	N	N	150	30	N	30	N	100	500	N	50	200	300	130
760[illegible]4000	15	150	70	50	N	N	70	20	N	20	N	100	300	N	30	200	200	140
760[illegible]4050	50	300	150	70	N	N	150	30	N	30	N	100	500	N	50	200	300	140
760[illegible]4100	15	200	70	70	N	N	100	30	N	20	N	100	500	N	30	200	150	150
760[illegible]4150	15	150	50	50	N	N	100	30	N	30	N	100	200	N	50	200	200	130
760[illegible]4200	20	200	70	50	N	N	100	30	N	30	N	100	200	N	50	200	200	120

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