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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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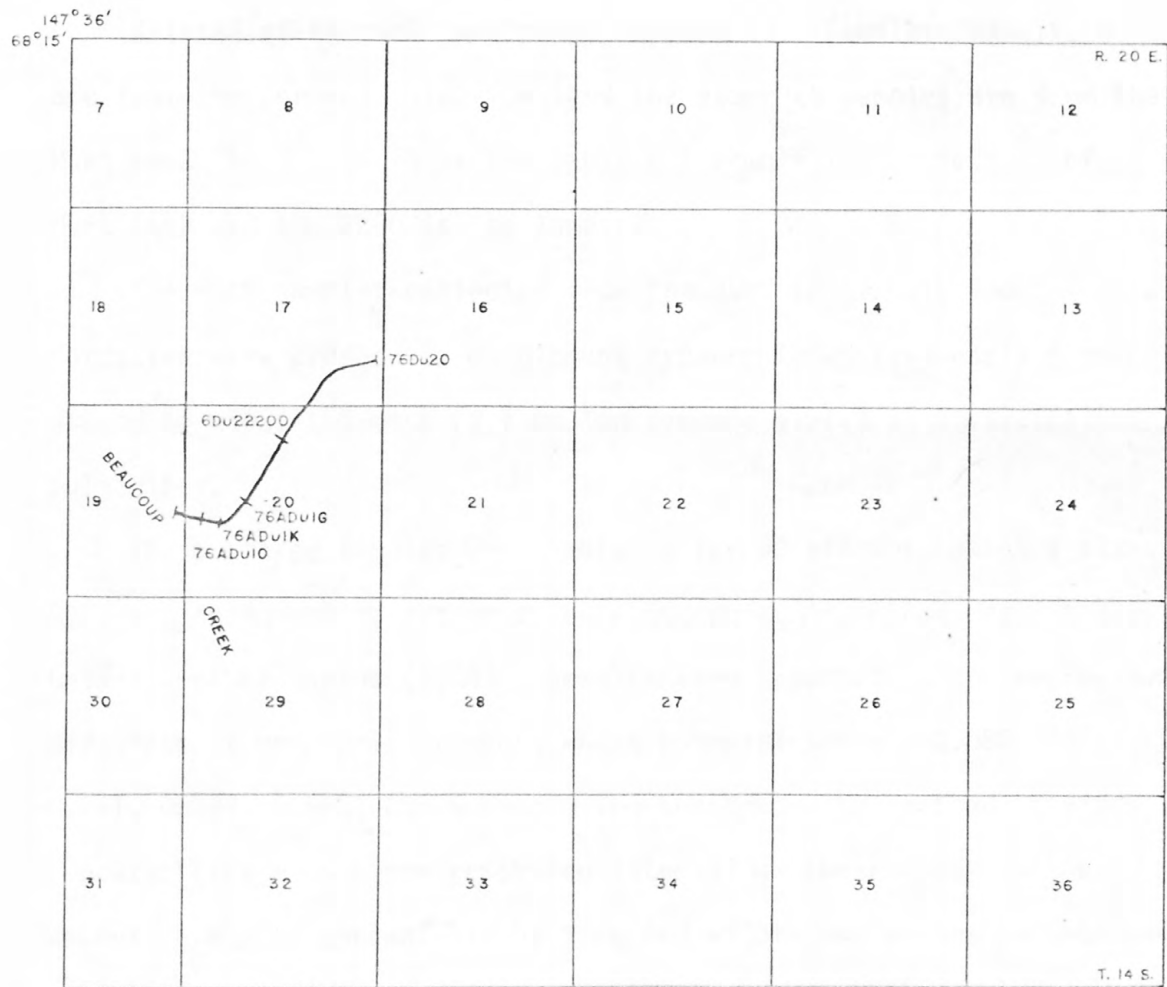
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More than 1400 m of fine-grained clastic rocks and reefoid limestones constitute the lower part of an Upper Devonian transgressive-regressive cycle in the central Brooks Range, Alaska (Dutro and others, 1977). The Hunt Fork Shale and an underlying 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).



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Philip Smith Mountains A-1 quadrangle, Arctic Alaska

Figure 1.-- Map showing location of measured section; upper and lower sample sites of the Hunt Fort Shale, 76Du20 and 6Du22200 respectively; and three sample sites from the underlying unnamed formation, (sections 17, 19, and 20, T. 14 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.

A-1 quadrangle, Alaska.

sample	LATITUDE	LONGITUDE	S-FEX	S-MGX	S-CAX	S-TIX	S-MN	S-AG	S-AS	S-AU	S-B	S-BA	S-BE	S-BI	S-CO
76ADU1K	68.2167	147.5667	15	5.0	3.0	1.0	700	N	N	N	100	700	1	N	N
76ADU1G	68.2167	147.5667	15	1.5	.5	1.0	1,000	N	N	N	100	700	3	N	N
76ADU1O	68.2159	147.5792	15	7.0	10.0	.7	1,000	N	N	N	70	500	N	N	N
76DU20	68.2250	147.5389	15	3.0	.3	1.0	1,000	N	N	N	100	700	2	N	N
76DU250	68.2250	147.5389	15	2.0	.2	.7	1,000	N	N	N	70	500	3	N	N
76DU2100	68.2250	147.5389	15	3.0	.2	.7	2,000	N	N	N	70	500	2	N	N
76DU2150	68.2250	147.5389	15	2.0	.2	1.0	1,500	N	N	N	100	500	2	N	N
76DU2200	68.2250	147.5389	15	2.0	.2	.7	1,500	N	N	N	100	500	3	N	N
76DU2250	68.2250	147.5389	15	2.0	.3	.7	1,500	N	N	N	100	500	3	N	N
76DU2300	68.2250	147.5389	15	2.0	.3	.7	2,000	N	N	N	70	500	3	N	N
76DU2350	68.2250	147.5389	10	1.5	.2	.7	1,500	N	N	N	70	500	3	N	N
76DU2400	68.2250	147.5389	15	2.0	.2	1.0	2,000	N	N	N	70	500	3	N	N
76DU2450	68.2250	147.5389	15	2.0	.2	1.0	1,500	N	N	N	100	700	3	N	N
76DU2500	68.2250	147.5389	15	3.0	.2	.7	1,500	N	N	N	70	700	3	N	N
76DU2550	68.2250	147.5389	15	3.0	.2	1.0	1,500	N	N	N	100	700	3	N	N
76DU2600	68.2250	147.5389	15	2.0	.1	.7	1,000	N	N	N	70	500	2	N	N
76DU2650	68.2250	147.5389	15	3.0	.2	1.0	1,500	N	N	N	70	700	2	N	N
76DU2700	68.2250	147.5389	15	5.0	.2	1.0	2,000	N	N	N	100	700	2	N	N
76DU2750	68.2250	147.5389	15	2.0	.2	.7	2,000	N	N	N	70	700	2	N	N
76DU2800	68.2250	147.5389	15	3.0	.3	.7	1,500	N	N	N	70	500	2	N	N
76DU2850	68.2250	147.5389	15	3.0	.3	1.0	1,500	N	N	N	70	500	2	N	N
76DU2900	68.2250	147.5389	10	2.0	.2	.7	1,500	N	N	N	50	500	3	N	N
76DU2950	68.2250	147.5389	15	3.0	.3	1.0	1,500	N	N	N	70	700	<1	N	N
6DU21000	68.2222	147.5500	15	3.0	1.0	1.0	1,500	N	N	N	100	700	2	N	N
6DU21050	68.2222	147.5500	15	3.0	.7	1.0	1,500	N	N	N	100	700	2	N	N
6DU21100	68.2222	147.5500	15	2.0	.3	.7	1,000	N	N	N	70	500	2	N	N
6DU21150	68.2222	147.5500	15	2.0	.5	1.0	1,000	N	N	N	70	700	2	N	N
6DU21200	68.2222	147.5500	15	2.0	.2	.7	1,500	N	N	N	70	500	2	N	N
6DU21250	68.2222	147.5500	15	3.0	.5	.7	1,500	N	N	N	70	700	2	N	N
6DU21300	68.2222	147.5500	15	2.0	.2	.7	1,500	N	N	N	70	500	2	N	N
6DU21350	68.2222	147.5500	5	1.5	.1	.5	1,500	N	N	N	50	500	3	N	N
6DU21400	68.2222	147.5500	15	2.0	.2	.7	1,500	N	N	N	70	500	2	N	N
6DU21450	68.2222	147.5500	10	1.5	.1	.7	1,000	N	N	N	70	500	3	N	N
6DU21500	68.2222	147.5500	15	2.0	.2	1.0	1,500	N	N	N	100	700	2	N	N
6DU21550	68.2222	147.5500	15	2.0	.5	.7	1,000	N	N	N	70	500	3	N	N
6DU21600	68.2222	147.5500	10	1.5	.2	.7	1,000	N	N	N	70	500	3	N	N
6DU21650	68.2222	147.5500	15	3.0	.3	1.0	1,500	N	N	N	100	500	2	N	N
6DU21700	68.2222	147.5500	15	1.5	.5	.7	1,500	N	N	N	70	500	3	N	N
6DU21750	68.2222	147.5500	15	1.5	.2	.7	1,500	N	N	N	70	500	3	N	N
6DU21800	68.2222	147.5500	15	3.0	.2	1.0	1,500	N	N	N	70	500	2	N	N
6DU21850	68.2222	147.5500	15	3.0	.1	1.0	1,000	N	N	N	70	500	2	N	N
6DU21900	68.2222	147.5500	15	2.0	.1	.7	1,000	N	N	N	70	500	3	N	N
6DU21950	68.2222	147.5500	15	3.0	.1	1.0	1,500	N	N	N	100	500	3	N	N
6DU22000	68.2200	147.5556	10	2.0	.1	.7	1,500	N	N	N	70	300	3	N	N
6DU22050	68.2200	147.5556	15	2.0	.2	1.0	1,500	N	N	N	100	500	3	N	N
6DU22100	68.2200	147.5556	15	3.0	.1	.7	1,500	N	N	N	70	500	3	N	N
6DU22150	68.2200	147.5556	15	2.0	.5	.7	2,000	N	N	N	70	500	3	N	N
6DU22200	68.2200	147.5556	15	2.0	.2	.7	1,000	N	N	N	70	500	3	N	N

Sample	S-CO	S-CR	S-CU	S-LA	S-MO	S-NU	S-NI	S-PO	S-SO	S-SC	S-SN	S-SR	S-V	S-W	S-Y	S-ZN	S-ZR	AA-ZN-P
76AD01K	70	700	100	30	N	N	200	30	N	30	N	100	500	N	50	200	500	120
76AD01G	20	200	100	100	N	N	150	30	N	20	N	100	500	N	50	N	500	110
76AD01O	50	300	200	20	N	N	150	30	N	30	N	150	500	N	30	N	150	120
76D020	50	300	100	70	N	N	150	30	N	30	N	100	500	N	50	200	500	120
76D0250	15	150	70	70	N	N	100	20	N	30	N	100	300	N	50	200	300	120
76D02100	100	300	100	70	N	N	150	50	N	30	N	100	500	N	50	300	300	120
76D02150	50	300	100	100	N	N	150	30	N	30	N	100	500	N	50	200	300	120
76D02200	30	150	100	70	N	N	100	30	N	30	N	100	300	N	50	300	300	120
76D02250	20	200	70	70	N	N	100	30	N	30	N	100	300	N	50	300	300	120
76D02300	30	300	100	70	N	N	150	30	N	30	N	100	300	N	50	300	300	120
76D02350	15	150	70	50	N	N	70	20	N	20	N	100	200	N	30	200	200	120
76D02400	30	200	200	70	N	N	150	30	N	30	N	100	500	N	50	300	300	130
76D02450	30	300	200	70	N	N	150	30	N	30	N	100	500	N	50	300	300	120
76D02500	15	150	200	50	N	N	100	50	N	20	N	100	300	N	30	200	150	120
76D02550	70	300	300	70	N	N	150	50	N	30	N	100	500	N	70	200	500	120
76D02600	15	300	70	70	N	N	100	20	N	30	N	100	300	N	50	300	200	130
76D02650	50	300	100	70	N	N	150	30	N	30	N	100	500	N	50	200	300	120
76D02700	70	500	150	100	N	N	200	50	N	30	N	100	500	N	70	300	300	130
76D02750	30	300	100	70	N	N	100	30	N	30	N	100	300	N	50	200	300	110
76D02800	20	300	100	70	N	N	100	30	N	30	N	100	300	N	50	300	150	110
76D02850	15	300	100	70	N	N	100	30	N	30	N	100	300	N	50	300	300	120
76D02900	15	200	70	70	N	N	70	20	N	20	N	100	200	N	50	200	300	120
76D02950	20	300	100	70	N	N	150	30	N	30	N	100	300	N	50	300	300	130
60D21000	50	300	150	30	N	N	150	30	N	30	N	100	500	N	30	200	200	120
60D21050	50	300	150	50	N	N	150	30	N	30	N	100	500	N	50	200	200	130
60D21100	15	200	100	70	N	N	100	15	N	20	N	100	200	N	30	200	200	120
60D21150	15	200	100	70	N	N	100	20	N	20	N	100	300	N	50	200	500	120
60D21200	15	150	100	70	N	N	100	20	N	20	N	100	300	N	30	200	300	100
60D21250	15	300	100	70	N	N	100	30	N	20	N	100	200	N	30	200	150	110
60D21300	15	150	70	70	N	N	100	20	N	20	N	100	300	N	30	200	300	110
60D21350	10	70	50	50	N	N	30	20	N	15	N	100	150	N	20	200	150	120
60D21400	20	200	70	70	N	N	150	30	N	30	N	100	300	N	50	200	200	130
60D21450	15	100	70	50	N	N	70	30	N	20	N	100	200	N	30	200	150	130
60D21500	30	300	100	70	N	N	150	30	N	30	N	100	500	N	50	200	500	120
60D21550	15	150	100	70	N	N	100	30	N	30	N	100	500	N	30	200	300	120
60D21600	15	150	100	70	N	N	100	20	N	20	N	100	500	N	30	200	200	110
60D21650	70	300	150	70	N	N	200	30	N	30	N	100	500	N	50	200	500	120
60D21700	15	200	100	70	N	N	150	30	N	20	N	100	300	N	50	200	300	110
60D21750	15	200	70	70	N	N	100	30	N	30	N	100	300	N	50	200	300	130
60D21800	70	300	150	70	N	N	200	50	N	30	N	100	500	N	50	200	300	130
60D21850	50	300	100	70	N	N	200	30	N	30	N	100	500	N	50	200	300	140
60D21900	20	150	70	70	N	N	100	30	N	30	N	100	300	N	30	200	200	140
60D21950	50	300	150	70	N	N	150	30	N	30	N	100	300	N	50	200	300	130
60D22000	15	150	70	50	N	N	70	20	N	20	N	100	300	N	30	200	200	140
60D22050	50	300	150	70	N	N	150	30	N	30	N	100	500	N	50	200	300	140
60D22100	15	200	70	70	N	N	100	30	N	20	N	100	300	N	30	200	150	150
60D22150	15	150	50	50	N	N	100	30	N	30	N	100	200	N	50	200	200	130
60D22200	20	200	70	50	N	N	100	30	N	30	N	100	200	N	50	200	200	120

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