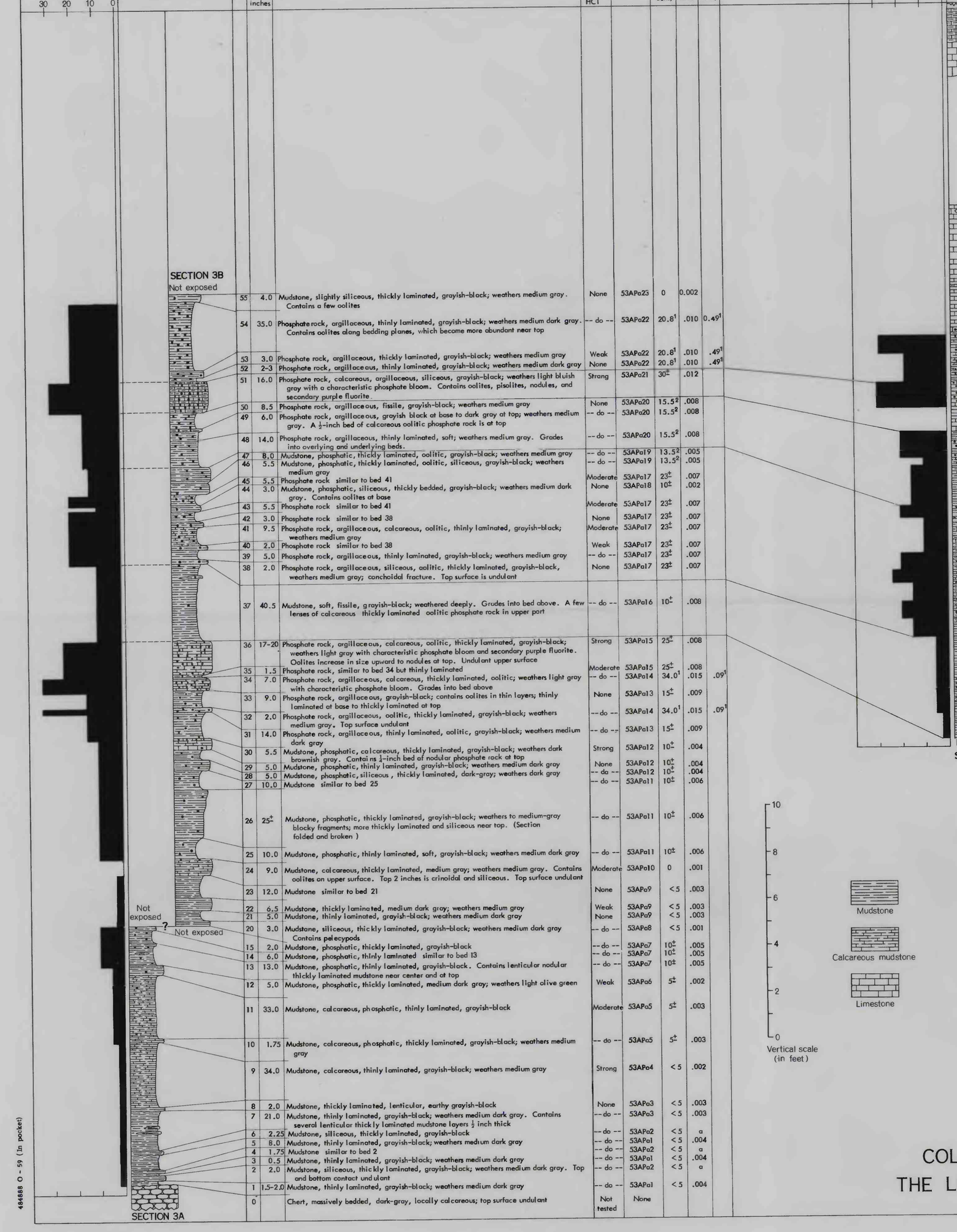

Bed No.	Thickness inches	Description	Reaction to dil. HCl	Sample No.	P_2O_5 (percent)	e U (percent)	V_2O_5 (percent)
55	4.0	Mudstone, slightly siliceous, thickly laminated, grayish-black; weathers medium gray. Contains a few oolites	None	53APa23	0	0.002	
54	35.0	Phosphate rock, argillaceous, thinly laminated, grayish-black; weathers medium dark gray. Contains oolites along bedding planes, which become more abundant near top	-- do --	53APa22	20.8[1]	.010	0.49[1]
53	3.0	Phosphate rock, argillaceous, thickly laminated, grayish-black; weathers medium gray	Weak	53APa22	20.8[1]	.010	.49[1]
52	2-3	Phosphate rock, argillaceous, thinly laminated, grayish-black; weathers medium dark gray	None	53APa22	20.8[1]	.010	.49[1]
51	16.0	Phosphate rock, calcareous, argillaceous, siliceous, grayish-black; weathers light bluish gray with a characteristic phosphate bloom. Contains oolites, pisolites, nodules, and secondary purple fluorite.	Strong	53APa21	30±	.012	
50	8.5	Phosphate rock, argillaceous, fissile, grayish-black; weathers medium gray	None	53APa20	15.5[2]	.008	
49	6.0	Phosphate rock, argillaceous, grayish black at base to dark gray at top; weathers medium gray. A ½-inch bed of calcareous oolitic phosphate rock is at top	-- do --	53APa20	15.5[2]	.008	
48	14.0	Phosphate rock, argillaceous, thinly laminated, soft; weathers medium gray. Grades into overlying and underlying beds.	-- do --	53APa20	15.5[2]	.008	
47	8.0	Mudstone, phosphatic, thickly laminated, oolitic, grayish-black; weathers medium gray	-- do --	53APa19	13.5[2]	.005	
46	5.5	Mudstone, phosphatic, thickly laminated, oolitic, siliceous, grayish-black; weathers medium gray	-- do --	53APa19	13.5[2]	.005	
45	5.5	Phosphate rock similar to bed 41	Moderate	53APa17	23±	.007	
44	3.0	Mudstone, phosphatic, siliceous, thickly bedded, grayish-black; weathers medium dark gray. Contains oolites at base	None	53APa18	10±	.002	
43	5.5	Phosphate rock similar to bed 41	Moderate	53APa17	23±	.007	
42	3.0	Phosphate rock similar to bed 38	None	53APa17	23±	.007	
41	9.5	Phosphate rock, argillaceous, calcareous, oolitic, thinly laminated, grayish-black; weathers medium gray	Moderate	53APa17	23±	.007	
40	2.0	Phosphate rock similar to bed 38	Weak	53APa17	23±	.007	
39	5.0	Phosphate rock, argillaceous, thinly laminated, grayish-black; weathers medium gray	-- do --	53APa17	23±	.007	
38	2.0	Phosphate rock, argillaceous, siliceous, oolitic, thickly laminated, grayish-black, weathers medium gray; conchoidal fracture. Top surface is undulant	None	53APa17	23±	.007	
37	40.5	Mudstone, soft, fissile, grayish-black; weathered deeply. Grades into bed above. A few lenses of calcareous thickly laminated oolitic phosphate rock in upper part	-- do --	53APa16	10±	.008	
36	17-20	Phosphate rock, argillaceous, calcareous, oolitic, thickly laminated, grayish-black; weathers light gray with characteristic phosphate bloom and secondary purple fluorite. Oolites increase in size upward to nodules at top. Undulant upper surface	Strong	53APa15	25±	.008	
35	1.5	Phosphate rock, similar to bed 34 but thinly laminated	Moderate	53APa15	25±	.008	
34	7.0	Phosphate rock, argillaceous, calcareous, thickly laminated, oolitic; weathers light gray with characteristic phosphate bloom. Grades into bed above	-- do --	53APa14	34.0[1]	.015	.09[1]
33	9.0	Phosphate rock, argillaceous, grayish-black; contains oolites in thin layers; thinly laminated at base to thickly laminated at top	None	53APa13	15±	.009	
32	2.0	Phosphate rock, argillaceous, oolitic, thickly laminated, grayish-black; weathers medium gray. Top surface undulant	-- do --	53APa14	34.0[1]	.015	.09[1]
31	14.0	Phosphate rock, argillaceous, thinly laminated, oolitic, grayish-black; weathers medium dark gray	-- do --	53APa13	15±	.009	
30	5.5	Mudstone, phosphatic, calcareous, thickly laminated, grayish-black; weathers dark brownish gray. Contains ½-inch bed of nodular phosphate rock at top	Strong	53APa12	10±	.004	
29	5.0	Mudstone, phosphatic, thinly laminated, grayish-black; weathers medium dark gray	None	53APa12	10±	.004	
28	5.0	Mudstone, phosphatic, siliceous, thickly laminated, dark-gray; weathers dark gray	-- do --	53APa12	10±	.004	
27	10.0	Mudstone similar to bed 25	-- do --	53APa11	10±	.006	
26	25±	Mudstone, phosphatic, thickly laminated, grayish-black; weathers to medium-gray blocky fragments; more thickly laminated and siliceous near top. (Section folded and broken)	-- do --	53APa11	10±	.006	
25	10.0	Mudstone, phosphatic, thinly laminated, soft, grayish-black; weathers medium dark gray	-- do --	53APa11	10±	.006	
24	9.0	Mudstone, calcareous, thickly laminated, medium gray; weathers medium gray. Contains oolites on upper surface. Top 2 inches is crinoidal and siliceous. Top surface undulant	Moderate	53APa10	0	.001	
23	12.0	Mudstone similar to bed 21	None	53APa9	<5	.003	
22	6.5	Mudstone, thickly laminated, medium dark gray; weathers medium gray	Weak	53APa9	<5	.003	
21	5.0	Mudstone, thinly laminated, grayish-black; weathers medium dark gray	None	53APa9	<5	.003	
20	3.0	Mudstone, siliceous, thickly laminated, grayish-black; weathers medium dark gray. Contains pelecypods	-- do --	53APa8	<5	.001	
15	2.0	Mudstone, phosphatic, thickly laminated, grayish-black	-- do --	53APa7	10±	.005	
14	6.0	Mudstone, phosphatic, thinly laminated similar to bed 13	-- do --	53APa7	10±	.005	
13	13.0	Mudstone, phosphatic, thinly laminated, grayish-black. Contains lenticular nodular thickly laminated mudstone near center and at top	-- do --	53APa7	10±	.005	
12	5.0	Mudstone, phosphatic, thickly laminated, medium dark gray; weathers light olive green	Weak	53APa6	5±	.002	
11	33.0	Mudstone, calcareous, phosphatic, thinly laminated, grayish-black	Moderate	53APa5	5±	.003	
10	1.75	Mudstone, calcareous, phosphatic, thickly laminated, grayish-black; weathers medium gray	-- do --	53APa5	5±	.003	
9	34.0	Mudstone, calcareous, thinly laminated, grayish-black; weathers medium gray	Strong	53APa4	<5	.002	
8	2.0	Mudstone, thickly laminated, lenticular, earthy grayish-black	None	53APa3	<5	.003	
7	21.0	Mudstone, thinly laminated, grayish-black; weathers medium dark gray. Contains several lenticular thickly laminated mudstone layers ½ inch thick	-- do --	53APa3	<5	.003	
6	2.25	Mudstone, siliceous, thickly laminated, grayish-black	-- do --	53APa2	<5	a	
5	8.0	Mudstone, thinly laminated, grayish-black; weathers medium dark gray	-- do --	53APa1	<5	.004	
4	1.75	Mudstone similar to bed 2	-- do --	53APa2	<5	a	
3	0.5	Mudstone, thinly laminated, grayish-black; weathers medium dark gray	-- do --	53APa1	<5	.004	
2	2.0	Mudstone, siliceous, thickly laminated, grayish-black; weathers medium dark gray. Top and bottom contact undulant	-- do --	53APa2	<5	a	
1	1.5-2.0	Mudstone, thinly laminated, grayish-black; weathers medium dark gray	-- do --	53APa1	<5	.004	
0		Chert, massively bedded, dark-gray, locally calcareous; top surface undulant	Not tested	None			

Bed No.	Thickness (in.)	Description	Reaction to dil. HCl	Sample No.	P_2O_5 (percent)	e U (percent)	V_2O_5 (percent)
-	19+	Limestone similar to bed below but more argillaceous	Not tested	---	---		
-	17.0	Limestone, dense, light medium-gray; weathers to a pale red "cotton" rock	-- do --	---	---		
-	-	Sequence is poorly exposed. Appears to be chiefly dark-gray fossiliferous argillaceous limestone and calcareous mudstone					
104	41.0	Limestone, siliceous, finely crystalline, medium dark-gray. Grayish-black chert nodules in upper 11 inches	-- do --	---			
103	1.0	Limestone, argillaceous, nodular, grayish-black, crinoidal	-- do --	---			
102	23.0	Limestone, medium dark-gray, crinoidal; weathers medium light gray; a few oolites at base	-- do --	---			
101	1.5	Mudstone, grayish-black, fossiliferous	-- do --	---			
100	9.0	Phosphate rock, calcareous, nodular, and oolitic, grayish-black, fossiliferous; weathers light gray. Bottom and top contacts undulant	Strong	53APa42	28.8[1]	0.022	0.07[1]
99	15.0	Phosphate rock, argillaceous, calcareous, oolitic, grayish-black; weathers medium gray with a characteristic phosphate bloom. Black calcareous "cannon ball" concretions	-- do --	53APa41	18.0[2]	.009	
98b	13.0	Phosphate rock, calcareous, grayish-black; oolites at base grading into nodules at top. Top contact undulant. Weathers light gray with characteristic phosphate bloom and secondary purple fluorite	-- do --	53APa40	30±	.014	
98a	13.0	Limestone, grayish-black, fossiliferous. Bottom contact undulant	---	53APa39	0	a	
97	13.5	Phosphate rock, argillaceous, thinly laminated, grayish-black. Oolitic near top. Irregular chert band near top	Weak	53APa38	19.8[1]	.006	.46[1]
96	4.0	Mudstone, phosphatic, calcareous, thickly laminated, grayish-black; weathers medium gray. Slightly oolitic. Top and bottom contacts undulant	Strong	53APa37	10±	.002	
95	20±	Phosphate rock, argillaceous, oolitic, thinly laminated, grayish-black. (May be faulted)	Weak	53APa36	15.5[2]	.007	
94	5.0	Phosphate rock similar to bed 91. 2- to 3-inch band of nodular grayish-black chert on top	Strong	53APa35	20.1[2]	.006	
93	19.0	Limestone, argillaceous, siliceous, phosphatic, grayish-black; weathers medium gray. A few oolites. Strong ledge maker	-- do --	53APa34	10±	.002	
92	3.5	Phosphate rock similar to bed 90	-- do --	53APa33	20±	.006	
91	3.5	Phosphate rock similar to bed 87	-- do --	53APa32	19.7[2]	.004	
90	2.5	Phosphate rock argillaceous, calcareous, oolitic, thinly laminated, grayish-black; weathers light bluish gray	-- do --	53APa31	20±	.007	
89	6.5	Phosphate rock similar to bed 87. Bottom contact undulant	-- do --	53APa30	23.6[2]	.007	
88	9.5	Phosphate rock, calcareous, argillaceous, grayish-black; weathers light gray. Oolites on top and bottom of bed. Limestone concretions as much as 24 inches in diameter	-- do --	53APa29	15±	.006	
87	9.0	Phosphate rock, argillaceous, calcareous, siliceous, oolitic; weathers light gray with characteristic phosphate bloom	-- do --	53APa28	19.6[2]	.007	
86	10.0	Phosphate rock, argillaceous, oolitic, grayish-black; weathers light gray	Weak	53APa27	15±	.005	
85	20.0	Mudstone, phosphatic, thickly laminated, grayish-black; weathers dark gray. Black ellipsoidal chert concretions as much as 24 inches in diameter near center. Black discoidal chert concretions as much as 14 inches in diameter near top	None	53APa26	5±	.003	
84	8.5	Mudstone, calcareous, thickly bedded grayish-black; weathers medium light gray. Black chert concretions 1½ inches in diameter with phosphate oolites	Strong	53APa26	5±	.003	
83	3.0	Limestone, argillaceous, siliceous, phosphatic, grayish-black; weathers medium light gray. Bottom and top contacts undulant	-- do --	53APa25	5±	.002	
82	8.0	Limestone, argillaceous, phosphatic, grayish-black; weathers medium light gray. Undulant upper contact	-- do --	53APa25	5±	.002	
81	5.0	Mudstone, calcareous, thinly laminated, grayish-black; weathers medium light gray	-- do --	53APa24	<5	.002	
80	7+	Mudstone, siliceous, grayish-black; weathers medium light gray	None	53APa24	<5	.002	

EXPLANATION

Mudstone
Calcareous mudstone
Limestone
Argillaceous limestone
Bedded chert
Chert nodules, concretions, and lenses
Limestone nodules, concretions, and lenses
Phosphate rock
Argillaceous phosphate rock

[1] Analyses for P_2O_5 and V_2O_5 by Maryse Delevaux, Wendell Tucker, and Esma Campbell, U. S. Geological Survey
[2] Analyses for P_2O_5 and V_2O_5 by Audrey Smith, U. S. Geological Survey
All others, J. J. Matzko, U. S. Geological Survey.
Analysis of equivalent uranium by Julius Goode, U. S. Geological Survey
P_2O_5 results by Matzko are approximate, based on a semiquantitative field test (Shapiro, Leonard, 1952)

COLUMNAR SECTIONS OF PHOSPHATIC ZONE OF THE LISBURNE GROUP, UPPER KIRUKTAGIAK RIVER AREA

484888 O - 59 (In pocket)