

THE CLEVELAND-CLIFFS IRON CO.

PROJECT: White River Shale Project

Bjorne &

HOLE NO. X-11 SHEET 1 OF 2 DATE: 12/20/74 LOGGED BY: Moulton T.D. 1023

DEPTH	INCH	FRK	PP	WAL/TON	CORE REC	LITH.	DESCRIPTION
691					691.38		OIL SHALE, light to medium brown (low to moderate grade)
692			58				with lenses & layers of SANDSTONE & CALCITE; numerous
693			80				sulfide minerals seen in flake form
694							
695							
696							
697							
698			83				
699							
700							
701			00				
702)
703) Sulfide flakes
704			50)
705			79.89				
706			77				SAND layer, oil rich
707			10.18				
708			68				OIL SHALE, darker zone, richer
709							
710			03.43				OIL SHALE, darker zone, richer
711			53				
712							
713			23.65				
714			54				
715			35				OIL SHALE, richer zone with SULFIDE flakes
716			88				
717							
718							
719			20.58				
720							
721			68		721.50		721.88-722.24 OIL SHALE, black zone
722							OIL SHALE, medium to dark brown with some black zones;
723							low to rich medium grade; SULFIDE flakes seen in most
724							area; a few SANDSTONE layers with BITUMEN?
725			50				
726	+140						
727							
728							OIL SHALE, dark zone
729							
730							
731			30				
732							
733							
734							734.60-734.68 SANDSTONE, tuffaceous
735							735.0-735.6 OIL SHALE; darker zone - rich
736	+130		8.5				
737			7.3				
738			6.4				
739			6.8				
740			9.3				

Drilled 30.12 Ft.
Recovered 30.32 Ft.

Drilled 31.28 Ft.
Recovered 23.66 Ft.

COMMENTS: Lost 7.34 ft. of core at bottom of hole.

Core depth is measured from ground level.

THE CLEVELAND-CLIFFS IRON CO.

PROJECT: White River Shale Project
Bjorne &HOLE NO. X-11 SHEET 2 OF 7 DATE: 12/20/74 LOGGED BY: Moulton T.D.1023.

DEPTH	+MM	FRX	PP	SAL/DOX	CORE REC.	LITH.	DESCRIPTION
741				12.8			
742			60	14.4			742.66-742.84 SANDSTONE, tuffaceous, impregnated with BITUMEN
743			31	9.9			
744				10.5			
745				21.1			
746	+120			21.2			
747				21.1			
748				21.1			
749				21.1			
750				21.1			
751				21.1			
752				7.5			
753			95	21.9			OIL SHALE, medium brown, low grade
754				12.4			
755			15	9.5			
756	+110		25	10.5			OIL SHALE, medium to dark brown
757				10.6			756.84-756.91, SANDSTONE, tuffaceous; impregnated with BITUMEN
758			32	17.4			758.46-758.68 SANDSTONE, tuffaceous
759				14.4			
760				11.2			
761				10.0			761.71-761.85 SANDSTONE, tuffaceous; oil saturated
762			00	9.0			
763				8.7			OIL SHALE, medium to dark brown
764				9.5			764.76-764.82 SANDSTONE, tuffaceous; oil saturated
765				12.1			
766	-100		95	20.0			766.43-766.95 SANDSTONE, tuffaceous, oil saturated
767				11.0			
768				10.4			
769			72	10.5			
770				9.7			
771				11.9			
772			30	11.2			
773				11.8			
774			78	11.9			774.39-774.60 SANDSTONE, tuffaceous, brown
775				13.4			
776	+90		91	9.7			775.87-776.14 SANDSTONE, tuffaceous, brown
777				11.6			
778				12.9			OIL SHALE, very calcareous
779				10.7			779.38-779.45 SANDSTONE
780			39	7.8			779.60-779.66 SANDSTONE
781		30°		15.3			
782				15.5			OIL SHALE, light to medium brown, low to medium grade; very hard; calcareous with layers of SANDSTONE
783				9.8			784.0-784.1 SANDSTONE layer
784				8.4			
785			30	5.1			
786	+80			6.8			
787				15.2			
788				12.7			
789				10.5			OIL SHALE, low grade
790			33	9.0			

Drilled 29.22 Ft.
Recovered 29.22 Ft.

COMMENTS:

THE CLEVELAND-CLIFFS IRON CO.

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Bjorne &

HOLE NO. X-11 SHEET 3 OF 7 DATE: 12/20/74 LOGGED BY: Moulton T.D. 1023

DEPTH	+	FRX	PP	WAL/TON	CORE REC.	LITH.	DESCRIPTION
791				9.4			
792				10.6			
793				15.9			792.95-793.05, SANDSTONE layer
794			86	6.5			793.60-795.78 UPPER WAVY BED, SANDSTONE, tuffaceous, concretionary
795				7.6			
796	+70			11.3			
797			70	10.4			
798				13.6			OIL SHALE, low grade
799				16.5			
800				16.0			
801				20.0			OIL SHALE, low grade: very thinly bedded: medium gray to some darker, very thin bands: hard, moderately calcareous
802				15.4			
803				10.0			
804				10.0			
805				6.6			
806	+60		68	8.7			805.9-807.1 Interval contains several very thin, intermittent zones of SANDSTONE, tuffaceous, blue-gray
807				12.7			
808				12.3			
809				6.6			
810				7.5			
811		1.3	20	8.2	811.20		OIL SHALE, dark brown, slightly-moderately calcareous
812		1.06		5.7			OIL SHALE, medium to dark brown-some black: banded, calcareous
813				10.6			
814				16.7			
815				12.0			
816	+50			8.7			
817				10.8			OIL SHALE, medium grade
818				19.6			
819				40.1			
820				14.1			OIL SHALE, dark brown to black
821				12.8			
822				13.1			
823				13.6			
824				14.3			
825				27.2			825.75-825.80 SANDSTONE, tuffaceous, brown: oil
826	+40			23.7			825.8-826.8, OIL SHALE, dark brown to black: banded: richer zone
827				14.1			
828				15.8			826.8-829.0 OIL SHALE, gray-light brown, finely laminar
829				34.5			OIL SHALE, dark brown to black: rich zone
830				18.6			
831				7.4			
832				5.7			SULFIDE layers
833				6.0			OIL SHALE, low grade
834				2.9			
835				5.2			SANDSTONE layers
836	+30			7.5			
837				3.9			
838				4.8			OIL SHALE, low to medium grade
839				2.7			
840				0.9			

Drilled 30.20 Ft.
Recovered 30.20 Ft.Drilled 30.50 Ft.
Recovered 30.50 Ft.

COMMENTS:

HOLE NO. X-11 SHEET 4 OF 7 DATE: 12/21/74 LOGGED BY: Moulton T.D. 1023

DEPTH	+NE	FRX	PP	GAL/TON	CORE REC.	LITH.	DESCRIPTION
841				2.6	841.70		
842				9.0			OIL SHALE, light to dark brown; some very dark brown to black, high-grade zones (thin)
843				13.1			
844				13.9			OIL SHALE, low grade (to 844.85)
845		52		41.6			OIL SHALE, richer (845.52-845.59)
846	+20			18.7			OIL SHALE, medium grade (to 846.33)
847		00		17.6			
848		94		14.1			
849		91		12.5			849.42, OIL SHALE, richer: 849.61-849.66, cozing BITUMEN
850				20.6			850.85-851.71, OIL SHALE; three high grade bands cozing BITUMEN
851				28.0			
852		95		28.3			
853				26.4			OIL SHALE, medium grade?
854				43.2			
855				42.8			855.63-855.87, SANDSTONE, tuffaceous bands & lenses
856	+10			30.8			
857				22.5			
858				18.9			
859		60		14.4			
860				10.8			
861				20.5			OIL SHALE, low grade
862				18.4			
863				11.8			
864				13.8			OIL SHALE, light medium gray with numerous very thin, intermittent dark gray colored zones of tuffaceous sandstone
865		82		16.5			865.57-866.03 MAHOGANY MARKER, SANDSTONE, tuffaceous
866	0			9.9			866.03-868.00 OIL SHALE, as above MARKER; however, the frequent thin tuffaceous zones are dark gray-black & white
867		04.07		8.8			
868				9.9			OIL SHALE, low grade
869				14.0			OIL SHALE, grade is increasing
870		44		18.8			870.70, NAHCOLITE
871				50.0	871.12		870.85 SANDSTONE, tuffaceous bands
872				26.6			OIL SHALE, relatively, higher grade
873		60		21.8			OIL SHALE, light to dark brown; locally higher grade with intermittent thin SANDSTONE lenses-higher grade overall
874				23.1			
875		38.59		14.7			
876	-10			19.0			
877		35		27.9			877.83-877.91 SANDSTONE
878				32.6			
879		48		29.8			
880		00.85		77.8			880.00-880.24, OIL SHALE, higher grade
881		17.45		73.4			880.24-880.80 LOST CORE
882				45.5			
883				63.9			OIL SHALE, higher grade (to 882.66 only)
884				32.8			883.00-883.47, LOST CORE; 883.75, Broken Core
885				19.1			
886	-20			41.3			
887				39.7			OIL SHALE, higher grade (to 888.06)
888				18.4			
889		33		18.0			888.06-890.70 OIL SHALE, medium grade
890		70		37.5			890.70-890.83, OIL SHALE, higher grade

Drilled 29.42 Ft.
Recovered 29.42 Ft.

Drilled 31.70 Ft.
Recovered 30.22 Ft.

COMMENTS:

* Mahogany Marker is tan to brown in color with somewhat contorted bedding saturated with hydrocarbons. The tuff zone has a fairly even lower contact and an undulating upper contact.

THE CLEVELAND-CLIFFS IRON CO.

PROJECT: White River Shale Project

Black &

HOLE NO. X-11 SHEET 5 OF 7 DATE: 12/21/74 LOGGED BY: Bjorne T.D.1023.

DEPTH	FRX	PP	AL/TON	CORE REC.	LITH.	DESCRIPTION
891			43.9			890.83-891.90, OIL SHALE, medium grade
892		97	46.0			891.90-892.03 SANDSTONE, with GILSONITE? filled fractures
893			44.5			892.03-892.75 LOST CORE; 892.47, Broken Core
894			22.1			
895			26.3			OIL SHALE, medium to higher grade
896	-30		42.8			
897			19.1			896.71-898.78, OIL SHALE, medium grade
898			15.3			898.78-898.91, OIL SHALE, higher grade
899		57	16.8			
900			31.1			899.77-901.84 OIL SHALE, higher grade
901			32.6			901.12, 901.22, 901.45, 901.85, 902.73 - thin SANDSTONE lenses
902			15.2			902.80-904.33, OIL SHALE, higher grade
903		28.73	9.8	902.82		
904		33	12.8			904.33-913.00, OIL SHALE, medium brown to black; moderate to high grade
905		00.85	10.1			
906	-40	40	13.7			
907		76	33.6			OIL SHALE, medium grade
908			29.3			
909		68	28.3			
910			25.7			
911			35.4			
912			22.0			OIL SHALE, medium grade with some high grade bands
913			21.0			
914			14.1			
915	-50	48	10.9			
916		85	11.4			
917		75	15.5			
918		54	28.3			
919		75	11.0			OIL SHALE, medium grade
920		27.46	9.1			
921		30.53	7.6			
922		80	5.3			
923		90	6.0			
924		07.80	15.7			
925		50	10.9			OIL SHALE, medium grade
926	-60	60	7.5			
927		10.59	26.1			
928		40	24.3			
929		21	9.2			
930		80	8.9			
931		75	20.4			No SAND layers in run (903-933)
932		67.94	35.0	932.94		OIL SHALE, light brown to black, low to medium grade with layers of high grade; thin SANDSTONE layers oozing oil
933		20	6.5			
934			5.1			
935		29	3.0			
936	-70		3.9			
937		35	3.7			
938			9.5			
939			31.5			940.59-940.73, 940.82-940.90, SANDSTONE, layers oil saturated
940			22.8			
941						

Drilled 30.12 Ft.
Recovered 30.12 Ft.

COMMENTS:

DEPTH	+NE	FRX	PP	GAL/TON	CORE REC.	LITH.	DESCRIPTION
942				13.4			
943				7.9			
944				6.2			
945				4.3			OIL SHALE, medium to low grade
946	-80			4.3			
947				6.9			
948				4.1			
949				5.1			
950				8.5			OIL SHALE, low to medium grade
951				3.0			
952		90°		7.4			
953			39	8.8			
954				6.1			
955				3.6			
956	-90			3.3			
957				4.4			
958				3.5			958.10-958.25. SANDSTONE, layers, oil saturated
959				3.2			
960				3.7			OIL SHALE, low grade with interbedded thin layers of
961				3.6			SANDSTONE, tuffaceous; oil saturated
962				4.8			962-968. OIL SHALE, low grade; silty, finely laminated
963			50	5.4			slightly calcareous with thin zones & seams that are
964				5.4			oil or tar saturated
965				4.6			
966	-100		60	3.1			OIL SHALE, with contorted beds
967				2.8			
968				2.1			968-970. OIL SHALE, light brown, low grade
969			35.65	7.4			
970			20.80	9.0			SANDSTONE, thin, coarse; oil saturated
971			20	5.0			970.5-971.0 OIL SHALE, oil saturated
972				3.8			OIL SHALE, low to medium grade; competent, non-calcareous
973				4.1			silty, finely laminated
974				3.6			
975				5.3			OIL SHALE as above with coarser zones bleeding oil
976	110			3.1			
977				2.1			OIL SHALE, light gray-buff, low grade; silty, competent
978				2.0			slightly calcareous
979				5.1			
980				5.5			
981				5.5			
982				1.7			
983			25.35	4.6			OIL SHALE, cream to buff, low grade; surface of core has
984			30.60	6.6			"pitted" look, contains several parting planes;
985			80				non-calcareous
986	1.8						OIL SHALE, gray, low grade; finer grained than above
987	90°						
988			70				OIL SHALE, brown-dark brown, medium grade; fine grained
989							finely laminated; some mildly distorted bedding
990			50				(around blebs)
991							OIL SHALE, light gray, very low grade; finely laminated

Drilled 30.30 Ft.
Recovered 30.30 Ft.

963.24

Drilled 29.56 Ft.
Recovered 30.22 Ft.

COMMENTS:

HOLE NO. X-11 SHEET 7 OF 7 DATE: 12/22/74 LOGGED BY: Carnahan & Kangas, T.D. 1023.

DEPTH	+MM	FRX	PP	WAT/ TON	CORE REC.	LITH.	DESCRIPTION
992					992.80		
993			00				OIL SHALE, light brown; bedding marked by thin SANDSTONE layers & blebs; oil saturated at 993.3
994							
995			50				
996	-130						
997			34				
998							PYRITE blebs
999			60				
1000			48.10				
1001			10.57				PYRITE blebs; 1001.8-1002.0 SANDSTONE
1002							OIL SHALE, light brown, low grade
1003							
1004			05				
1005							SANDSTONE, oil saturated
1006	-140		13.60				
1007							
1008			58				
1009			25				1009.5, oil saturated zone
1010							PYRITE, lenses; 1010.3, oil saturated zone
1011			22.65				SHALE, low grade with dark bands
1012							
1013							
1014			92				
1015							
1016	-150		06				
1017			06.15				
1018			62				SANDSTONE, thin layer
1019			32.68				
1020							
1021			94				
1022							
1023					1023.00		Hole Complete

Drilled 30.20 Ft.
 Recovered 30.20 Ft.

COMMENTS: