

HOLE NO. X-5 SHEET 1 OF 2 DATE: 1/6/75 LOGGED BY: Sundberg T.D.

DEPTH	ME	FRX	PP	GAL/TON	CORE REC.	LITH.	DESCRIPTION
0							Overburden
60							No Sample (cuttings mixed with cement)
70							
80							
90							
100							
110							
120							
130							
140							
150							
160							
170							
180							
190							SILTSTONE, fine grained, light brown with SANDSTONE
200							SANDSTONE, light gray
210							SANDSTONE, light gray
220							SILTSTONE, light brown & SANDSTONE, gray
230							SANDSTONE, light gray
240							SANDSTONE, light gray
250							SANDSTONE, light gray
260							SANDSTONE, light gray & SILTSTONE, light brown
270							SANDSTONE, light gray & SILTSTONE, light brown
280							SILTSTONE, light brown to medium brown
290							SILTSTONE, light brown to medium brown
300							SILTSTONE, light brown to medium brown
310							SHALE, medium to dark brown
320							SHALE, medium to dark brown
330							SHALE, medium to dark brown
340							SHALE, dark brown with some medium brown chips
350							SHALE, dark brown with some medium brown chips
360							SHALE, dark brown with some medium brown chips
370							SHALE, medium to dark brown with a few gray chips
380							SHALE, medium to dark brown with a few gray chips
390							SHALE, medium to dark brown with a few gray chips
400							SANDSTONE, light gray & SHALE, light to dark brown
410							SANDSTONE, light gray & SHALE, light to dark brown
420							SANDSTONE, light gray & SHALE, light to dark brown
430							SHALE, light to dark brown with some gray chips
440							SHALE, light to dark brown with some gray chips
450							SHALE, light to dark brown with some gray chips
460							SHALE, light to dark brown with some gray chips
470							SHALE, light to dark brown with some gray chips
480							SHALE, light to dark brown with some gray chips
490							Cuttings, reddish brown (fine-tricone bit grinds)
500							SHALE, SANDSTONE, brown to reddish brown, fine grind
510							SHALE, SANDSTONE, brown to reddish brown, fine grind
520							SHALE, SANDSTONE, brown to reddish brown, fine grind
530							SHALE, SANDSTONE, brown to reddish brown, fine grind
540							SILTSTONE, reddish brown, fine grained

COMMENTS:

HOLE NO. X-5 SHEET 2 OF 2 DATE: 1/7/75 LOGGED BY: Kangas T.D.

[illegible]

COMMENTS: Rotary drilling with tri-cone bit - too much H₂O for hammer. Chips are small.

NOTE: Mistake in depth of hole - chip samples ended at 651.40 Ft. Location of mistake is unknown.

HOLE NO. X-5 SHEET 1 OF 6 DATE: 1/8/75 LOGGED BY: Sundberg T.D. 935.

DEPTH	+MM	FRX	PP	GAL/TON	CORE REC.	LITH.	DESCRIPTION
652			.89				SHALE, light gray, thinly bedded
653			.25				SHALE, light gray-light brown, thinly bedded
654							SHALE, light gray-light brown, thinly bedded
655			.45-.87				SHALE, light gray-light brown, thinly bedded
656			.42				SHALE, light gray-light brown, thinly bedded
657							SHALE, light gray-light brown, thinly bedded
658							SHALE, light brown with dark brown bedding
659							SHALE, light gray to light brown; thinly bedded
660			.60				SHALE, light gray to light brown; thinly bedded; SANDSTONE
661	+150						SHALE, light gray to light brown; thinly bedded; calcareous
662							SHALE, light gray to light brown; thinly bedded; calcareous
663			.75				SHALE, light gray to light brown; thinly bedded; calcareous
664							SHALE, light gray to light brown; thinly bedded; calcareous
665							SHALE, light brown with dark banding; calcareous
666			.72				SHALE, dark to light brown or gray; fine bedding; calcareous
667			.53				SHALE, light brown with SANDSTONE, gray lenses
668							SHALE, light brown with SANDSTONE, gray lenses
669							SHALE, light brown with SANDSTONE, gray lenses
670			.42				SHALE, light brown; thinly bedded; calcareous
671	+140						SHALE, light brown; thinly bedded; calcareous
672				.17			SHALE, light to dark brown
673			.20.73				SHALE, light brown with some gray lenses
674			.32.83				SHALE, light brown, thinly bedded; calcareous
675							SHALE, light brown, thinly bedded; calcareous
676			.47				SHALE, light brown, thinly bedded; calcareous
677			.10				SHALE, light gray to buff
678							OIL SHALE, buff to dark brown; 678.17 SANDSTONE, 1' band
679							OIL SHALE, buff to dark brown; 679.50, SANDSTONE, 1' lens
680			.89				OIL SHALE, light buff with thin gray bedding
681	+130		.65.75	6.9	681.65		OIL SHALE, light buff with thin gray bedding
682				6.0			OIL SHALE, light-dark brown, fine banding; slightly calcareous
683				6.7			OIL SHALE, light-dark brown, fine banding; slightly calcareous
684				8.9			OIL SHALE, " " " " " "
685				12.8			OIL SHALE, light-dark brown, fine banding; slightly calcareous
686			.63	11.7			OIL SHALE, light-dark brown, fine banding; slightly calcareous
687				11.4			OIL SHALE, " " " " " "
688			.83	9.4			OIL SHALE, " " " " " "
689				10.1			OIL SHALE, buff to brown, with bands of oily SANDSTONE
690				11.2			OIL SHALE, buff to brown, with bands of oily SANDSTONE
691	+120			26.1			OIL SHALE, light brown with dark bands; slightly calcareous
692			.40	24.2			OIL SHALE, dark brown; SANDSTONE bands with oil
693			.17	9.6			OIL SHALE, light to medium brown; fine bedding; slightly calcareous
694				7.0			OIL SHALE, " " " " " "
695			.07.91	1.8			OIL SHALE, " " " " " "
696			.69	2.9			OIL SHALE, " " " " " "
697			.36	10.1			OIL SHALE, " " " " " "
698				24.3			OIL SHALE, light brown with dark brown bedding; slightly calcareous
699			.28	11.6			OIL SHALE, light to medium brown
700			.79	9.1			OIL SHALE, light to medium brown
701	+110			13.1			OIL SHALE, medium-dark brown with SANDSTONE, oil satur

COMMENTS:

DEPTH	+MM	FRX	PP	VAL/ TON	CORE REC.	LITH.	DESCRIPTION
702				8.9			OIL SHALE, light-medium brown; SANDSTONE, oil saturate
703			50	13.6			OIL SHALE, light-medium brown; SANDSTONE, oil saturate
704				17.9			OIL SHALE, dark brown; 704.40-704.50, SANDSTONE, oil saturate
705				12.5			OIL SHALE, light to dark brown (banding)
706			64	9.6			OIL SHALE, light to dark brown (banding)
707			45	10.9			OIL SHALE, light-medium brown, fine bedding
708				8.8			OIL SHALE, light-medium brown with oily SANDSTONE layer
709				8.5			OIL SHALE, light-medium brown
710			35	11.6			OIL SHALE, light brown with dark brown banding
711	-100			14.2	712.05		OIL SHALE, light brown with dark brown banding
712			87.42	16.2			
713			29	11.9			OIL SHALE, light brown with oil saturated SANDSTONE
714			02	10.9			OIL SHALE, light to medium brown, mottled; (713.07-714.00) faint bedding marked by thin SANDSTONE bands
715			10.59	11.5			OIL SHALE, " lenses, moderately effervescent,
716			36	9.7			OIL SHALE, " " " "
717			23	12.5			OIL SHALE, " " " "
718			38	10.8			OIL SHALE, " " " "
719			35	11.3			OIL SHALE, " " " "
720			13.35	11.3			OIL SHALE, mottled, faint bedding; moderately efferve
721	+90		62	12.9			OIL SHALE, mottled, faint bedding; moderately efferve
722			60.85	10.9			OIL SHALE, mottled, faint bedding; moderately efferve
723			83	11.2			OIL SHALE, mottled, faint bedding; moderately efferve
724			83	13.8			OIL SHALE, mottled, faint bedding; moderately efferve
725			92.67.92	11.1			OIL SHALE, mottled, faint bedding; moderately efferve
726			40	8.7			OIL SHALE, light to medium brown, medium grade
727				14.1			OIL SHALE, light to medium brown, medium grade
728				15.4			728.22-728.42, SANDSTONE, oil saturated; 728.20-728.3
729				10.5			SANDSTONE, oil saturated
730			22	10.0			730.22-730.42, SANDSTONE, oil saturated; 730.42-731.0
731	+80		43	6.2			731.00-731.50, OIL SHALE, high grade, dark
732				5.5			OIL SHALE, medium brown, medium grade
733			79	10.5			OIL SHALE, medium to light brown, medium to low grade
734				17.0			OIL SHALE, medium to light brown, medium to low grade
735			72	11.5			OIL SHALE, medium to light brown, medium to low grade
736			85	9.8			OIL SHALE, medium to light brown, medium to low grade
737				10.0			OIL SHALE, medium to light brown, medium to low grade
738				8.4			OIL SHALE, medium to light brown; medium to low grade
739			55	15.6			OIL SHALE, medium to light brown, medium to low grade
740			52	10.2			940.52-742.28 UPPER WAVY BED (TUFACEOUS SANDSTONE)
741	+70		25	5.3	742.28		
742			28.65	4.2			742.28-742.80 UPPER WAVY BED (End of SANDSTONE)
743				3.4			OIL SHALE, medium brown, medium grade; a few dark brown
744			52	11.3			OIL SHALE, " " " "
745				14.0			OIL SHALE, " " " "
746			72	16.2			OIL SHALE, " " " "
747				15.0			OIL SHALE, " " " "
748				20.2			OIL SHALE, " " " "
749				13.7			OIL SHALE, " " " "
750			64	10.1			OIL SHALE, " " " "
751	+60		29	9.0			OIL SHALE, " " " "

Drilled 30.23 Ft.
Recovered 30.23 Ft.

COMMENTS:

THE CLEVELAND-CLIFFS IRON CO.

PROJECT: White River Shale Project

Kangas &

HOLE NO. X-5

SHEET 3 OF 6

DATE: 1/8/75

LOGGED BY: Sundberg T.D.

DEPTH	+MM	FRX	PP	GAL/TON	CORE REC.	LITH.	DESCRIPTION
752				6.5			OIL SHALE, medium brown, medium grade
753				9.5			OIL SHALE, medium brown, medium grade
754				12.4			OIL SHALE, medium brown, medium grade
755				12.7			OIL SHALE, medium brown, medium grade
756				6.8			OIL SHALE, medium brown, medium grade
757				7.2			OIL SHALE, medium brown, medium grade
758				8.5			OIL SHALE, medium brown, medium grade
759			53	5.8			OIL SHALE, medium brown, medium grade; a few dark brown
760			61	10.1			OIL SHALE, " " " " "
761	+50			16.4			OIL SHALE, " " " " "
762			03	12.9			OIL SHALE, " " " " "
763			35	9.2			OIL SHALE, " " " " "
764				9.0			OIL SHALE, " " " " "
765			16	13.7			OIL SHALE, " " " " "
766				14.7			OIL SHALE, " " " " "
767			26.75	17.8			OIL SHALE, " " " " "
768			40	11.8			OIL SHALE, " " " " "
769				12.1			OIL SHALE, " " " " "
770		.30	82	13.1			OIL SHALE, " " " " "
771	+40		40.70	13.8			OIL SHALE, " " " " "
772			55	17.2			OIL SHALE, " " " " "
773			92	32.1			OIL SHALE, medium brown, medium grade; a few dark brown
774				14.4			OIL SHALE, " " " " "
775			70	14.8			OIL SHALE, " " " " "
776			75	27.0			OIL SHALE, " " " " "
777				21.0			OIL SHALE, " " " " "
778			28.65	7.2			OIL SHALE, " " " " "
779			22.87	5.2			OIL SHALE, medium brown, medium grade; a few dark brown
780			11.30	5.0			OIL SHALE, " " " " "
781	+30		70	2.4			OIL SHALE, " " " " "
782			55	6.8			OIL SHALE, light brown, low grade; calcareous
783			17.83	4.1			OIL SHALE, light brown, low grade; calcareous
784			00.66	4.7			OIL SHALE, light brown, low grade; calcareous
785			20.44	2.5			OIL SHALE, light gray-brown, with fine dark brown bed
786			08.69	1.4			OIL SHALE, light gray-brown with fine dark brown bed
787				0.9			OIL SHALE, light gray-brown with fine dark brown bed
788			77	4.1			OIL SHALE, light gray-brown with fine dark brown bed
789				13.4			OIL SHALE, light gray brown to light brown; low grade
790			95	14.0			OIL SHALE, light gray brown to light brown; low grade
791	+20			13.8			OIL SHALE, light brown with dark brown, irregular bed
792			09.57	18.5			OIL SHALE, " " " " "
793			09.34	14.5			OIL SHALE, " " " " "
794			30.69	16.5			OIL SHALE, light brown with dark brown, irregular bed
795			20	33.1			OIL SHALE, light brown, medium grade; dark brown band
796			10.75	16.0			OIL SHALE, light brown, medium grade; dark brown band
797			55	17.4			OIL SHALE, light brown, medium grade; dark brown band
798			83	32.6			OIL SHALE, medium brown, medium grade
799			66	24.6			OIL SHALE, medium brown, medium grade with oily SANDS
800				26.0	801.95		
801	+10			43.6			

Drilled 30.40 Ft.
Recovered 30.40 Ft.

772.55

Drilled 28.90 Ft.
Recovered 28.90 Ft.

COMMENTS:

THE CLEVELAND-CLIFFS IRON CO.

PROJECT: White River Shale Project

Kangas &

HOLE NO. X-5 SHEET 4 OF 6 DATE: 1/9/75 LOGGED BY: Sundberg T.D. 935

DEPTH	+MM	FRX	PP	GAL/TON	CORE REC.	LITH.	DESCRIPTION
802			25.43	38.4			
803			.05	25.1			OIL SHALE, medium brown, medium grade with dark brown
804				19.9			"bands & SANDSTONE, oil saturated "
805			.90	18.8			OIL SHALE, medium brown, medium grade with dark brown
806				10.9			OIL SHALE, " " " " "
807				19.2			OIL SHALE, " " " " "
808				10.7			OIL SHALE, " " " " "
809			.78	17.3			OIL SHALE, " " " " "
810			.64	13.4			OIL SHALE, " " " " "
811	0		50.80	14.9			811.48-811.90 MAHOGANY MARKER
812			.90	11.7			OIL SHALE, medium brown, medium grade with dark brown
813				48.9			OIL SHALE, dark brown, medium grade
814			.65	27.4			OIL SHALE, dark brown, medium grade
815				9.5			OIL SHALE, medium brown, medium grade with dark brown
816			.88	13.7			OIL SHALE, " " " " "
817			.05.72	16.0			OIL SHALE, " " " " "
818			.20.63	20.2			OIL SHALE, " " " " "
819			.85.55	23.5			OIL SHALE, " " " " "
820			.07.58	16.4			OIL SHALE, " " " " "
821	-10			35.1			OIL SHALE, " " " " "
822			.00	33.1			OIL SHALE, " " " " "
823			.12	46.4			OIL SHALE, " " " " "
824			.03.37	49.3			OIL SHALE, " " " " "
825			.45.92	79.3			OIL SHALE, medium brown with dark brown bands
826			.60.73	71.8			OIL SHALE, medium brown with dark brown bands
827			.33.97	43.0			OIL SHALE, medium brown with dark brown bands
828			.10.37	34.4			OIL SHALE, medium brown with dark brown bands
829			.45.75	57.5			OIL SHALE, medium brown with dark brown bands
830			.69	35.0			OIL SHALE, dark brown, medium grade
831	-20		.90	20.4			OIL SHALE, medium brown (dark banded) with SANDSTONE l
832			.95	19.4			Oil Shale, " " " " "
833			11.45	29.3			OIL SHALE, " " " " "
834			.55	35.9			OIL SHALE, medium to dark brown, distinct banding; med
835			.26	16.2			OIL SHALE, " " " " "
836			.40	16.9			OIL SHALE, " " " " "
837			.35	45.4			OIL SHALE, " " " " "
838			.18.80	38.5			OIL SHALE, " " " " "
839			.86	37.8			838.86, SANDSTONE band
840				30.5			839.74, GILSONITE filled fracture
841	-30		.67	20.0			OIL SHALE, medium to dark brown, thick bedding; high gra
842				33.3			
843				34.9			OIL SHALE, as above; bedding marked by SANDSTONE, l
844				18.7			OIL SHALE, " " " " "
845			.06	14.7			OIL SHALE, " " " " "
846			.21.27	32.4			OIL SHALE, " " " " "
847			.94	21.0			OIL SHALE, medium to dark brown, thickly banded
848				30.0			OIL SHALE, medium to dark brown, thickly banded
849				13.3			OIL SHALE, medium to dark brown, thickly banded; 1"
850			.12.93	10.3			OIL SHALE, as above; dark bands of SANDSTONE calcareou
851	-40			10.7			OIL SHALE, " " " " "

Drilled 30.50 Ft.
Recovered 29.70 Ft.

331.95

Drilled 31.55 Ft.
Recovered 30.25 Ft.

COMMENTS:

DEPTH	+MM	FRX	PP	GAL/TON	CORE REC.	LITH.	DESCRIPTION
852			23.60	10.6			OIL SHALE, medium to dark brown; medium grade; thick
853			13	10.5			OIL SHALE, " bedded, marked by SANDSTONE lenses "
854			58	12.7			OIL SHALE, " " "
855			30	23.0			OIL SHALE, " " "
856			52	26.6			OIL SHALE, " " "
857			40	23.7			OIL SHALE, " " "
858			15.95	36.1			OIL SHALE, " " "
859			57	29.4			OIL SHALE, " " "
860			63.94	21.4			OIL SHALE, " " "
861	-50		72	19.8			OIL SHALE, " " "
862				33.4			OIL SHALE, " " "
863			50		863.50		OIL SHALE, " " "
864							OIL SHALE, " " "
865			71	13.1			OIL SHALE, light brown, low grade; thinly laminated
866			42	16.4			OIL SHALE, light brown, low grade; thinly laminated
867				25.0			867.50-867.70, SANDSTONE 1/2" irregular, moderate
868				10.2			OIL SHALE as above
869			53.64	9.5			OIL SHALE, light brown - buff, low grade
870			48.79	7.3			OIL SHALE, light brown - buff, low grade
871	-60		27	4.7			OIL SHALE, light brown - buff, low grade
872				8.2			OIL SHALE, light brown - buff, low grade
873			33	20.0			OIL SHALE, light brown - buff, low grade
874				9.2			OIL SHALE, light brown - buff, low grade
875				7.4			874.92-875.30 SANDSTONE band
876			41	16.8			876.63-876.72 SANDSTONE, oil saturated
877			48	34.2			OIL SHALE, medium brown, medium grade
878				11.1			OIL SHALE, medium brown, medium grade
879			78	7.9			OIL SHALE, medium brown, medium grade
880			22	12.1			OIL SHALE, medium brown, medium grade
881	-70		50	37.8			OIL SHALE, medium brown, medium grade; 881.50-882.86, grade zone
882			86	24.9			882.86, SANDSTONE, thin, oil saturated; OIL SHALE as
883			20.34	7.2			OIL SHALE, medium brown, medium grade
884			32.84	4.3			OIL SHALE, light brown, low grade
885			04.17	2.8			OIL SHALE, light brown, low grade
886			56	3.6			OIL SHALE, medium brown, medium grade
887			36	5.4			OIL SHALE, medium brown, medium grade
888			09.93	21.4			OIL SHALE, medium brown, medium grade
889			08	15.5			888.90-890.30, interbedded SANDSTONE & OIL SHALE, thin
890				19.1			low grade; lower SANDSTONE is oil satur
891	-80			15.5			OIL SHALE, medium brown, medium grade
892			72	12.5			OIL SHALE, medium brown, medium grade
893				7.3	894.00		OIL SHALE, medium brown, medium grade
894			22.54	7.2			OIL SHALE, light to medium brown, low grade, finely
895				6.0			laminated with occasional very thin layers
896			74	7.6			brown beds of hematite, pyrite & sandstone,
897				5.6			occasional very thin tuffaceous layers with
898			78	6.2			NAHCOLITE aggregates; slightly to moderate
899				6.4			calcareous.
900				6.5			
901	-90			6.4			

Drilled 30.50 Ft.
Recovered 30.40 Ft.

COMMENTS:

DEPTH	+NE	FRX	PP	GAL/TON	CORE REC.	LITH.	DESCRIPTION
902				10.0			OIL SHALE as above
903				7.2			OIL SHALE as above
904				4.7			OIL SHALE as above with moderate grade layers
905				4.9			OIL SHALE, low-moderate grade, medium brown (905.9-923)
906				8.2			
907				9.3			High grade zone (oozing oil)
908				8.2			
909				8.5			909.53-909.55 SANDSTONE, tuffaceous with minor NAHCOLITE
910				8.8			Moderate high grade zones (layers)
911	-100			7.8			
912				9.5			
913				8.9			NAHCOLITE, as distinct layers in rich oil shale zone
914				8.9			
915				6.4			
916				5.5			Slightly - moderately calcareous
917				6.4			
918				7.3			
919				7.2			
920				3.5			
921	-110			2.6			
922				4.2			
923				3.5	924.30		923.2 Total Depth, SHALE, light gray-brown, thin to
924				6.0			finely laminated; silty non-calcareous, hard; numerous
925				2.9			HEMATITE-PYRITE pods
926				2.1			
927				1.9			
928				1.8			
929				2.9			
930							
931	-120						
932							
933							
934							
935					935.30		T. D. 935.30

COMMENTS: