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ABSTRACT

The Premium Homestead Akpatok F-26 well was drilled on Akpatok Island in 1969 and penetrated the Ordovician Ship Point Formation. A total of 41 core samples were collected from this well for Rock-Eval[6] programmed pyrolysis. The rocks of Ship Point Formation are immature with poor to fair petroleum source rock potential.

INTRODUCTION

Akpatok Island is located in Ungava Bay between Northern Quebec and Nunavut (Fig. 1A). It is one of many Ordovician outliers on the Canadian Shield, and the only one location that exposes the Ordovician strata in Ungava Bay.

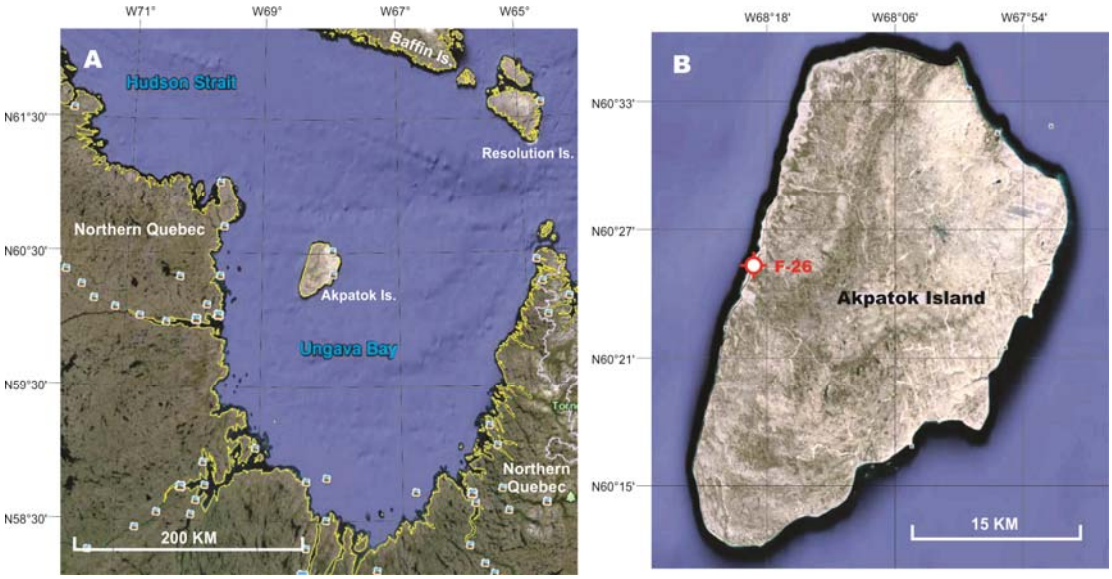

Figure 1. Location of Akpatok Island (A) and Premium Homestead Akpatok F-26 well (B) on a Google Maps base (Imagery ©2014 Terrametrics, Map data ©2014 Google, data downloaded March 10, 2014).

The Ordovician geology and hydrocarbon potential on Akpatok Island and surrounding marine area is mainly known from 1) geophysical investigation by the Bedford Institute during the 1965–1968 period (Grant and Manchester, 1970); 2) a single test borehole (Fig. 1B), Premium Homestead Akpatok F-26 at 60°25′40″N, 68°20′30″W, drilled for hydrocarbon by Premium Iron Ores Ltd. in 1969 (Kerkhoff, 1971), 3) three stratigraphic sections measured near Premium Homestead Akpatok F-26 well site and fossils collected from these sections on the west coast of the island (Workum et al., 1976) and 4) Rock-Eval[2] data collected from three samples of the Ordovician sections on the island (Macauley, 1987).

Premium Homestead Akpatok F-26 well was terminated at 1217′ and entirely cored from 935′ downward. Precambrian gneiss was penetrated between 1188′ and 1217′, and sandstone, siltstone, limestone and shale from 50′ to 1188′ (Kerkhoff, 1971). The conodont fauna collected from the interval of 867′–979′ of the well show similarity to that of the upper part of the Ship Point Formation of Foxe Basin, with an age of Early and early Middle Ordovician (Workum et al., 1976). The mega-fossil collection from the three outcrop sections near Premium Homestead Akpatok F-26 well site indicated that the rocks exposed on Akpatok Island range in age from very

late Middle Ordovician to early Late Ordovician and with a total thickness about 500′ (Workum et al., 1976).

Workum et al. (1976) noted that there is probably less than 2000′ of sedimentary section anywhere within Ungava Bay; and the clay encountered in the borehole has not been compacted sufficiently to produce shale suggests that there has probably never been sufficient overburden pressure to generate hydrocarbon. Macauley (1987) tested three outcrop samples from Akpatok Island; on the average, these samples contain 1.28% Total Organic Carbon (TOC) with T_{max} 429°C and Production Index (PI) 0.035. These results (Macauley, 1987) support the low maturity interpretation of Workum et al. (1976).

With the increased interest in hydrocarbon exploration in the Canadian Arctic, it is apparent that new data are needed in helping to re-assess the petroleum potential of Ungava Bay and Hudson Strait. The Nunavut Energy Project initiated by the Canada-Nunavut Geoscience Office and the Geo-mapping for Energy and Mineral Program II have defined a project to improve the knowledge about Paleozoic stratigraphy, thermal maturity and petroleum potential in Ungava Bay and Hudson Strait, i.e., the Hudson-Ungava project. This include detailed studies on the Lower Paleozoic stratigraphy, biostratigraphy and petroleum potential on Akpatok Island (to start in summer 2014), and Rock Eval^6 pyrolysis using the existing core from the early exploration (this study).

SAMPLES

The core log and details of sampling for Rock-Eval^6 pyrolysis are summarized in Appendix 1. A total of 41 core samples were collected from the interval between 935′2″ and 1077'6" of Premium Homestead Akpatok F-26 at the Canada-Nova Scotia Offshore Petroleum Board Core Lab. This interval is approximately correlated to the Ship Point Formation in Foxe Basin, and is mainly composed of sandstone, siltstone, shale and carbonate (Fig. 2). The samples were collected from shale within this interval.

EXPERIMENT AND GUIDELINES FOR INTERPRETATION

Rock-Eval^6 data for 41 samples (Fig. 3; Appendix 2) were collected by Rock-Eval^6 analyzer at the Organic Geochemistry Laboratory of the Geological Survey of Canada in Calgary. The Rock-Eval^6 experimental procedures and its application to hydrocarbon exploration are given by Lafargue et al. (1998) and Behar et al. (2001). The guidelines developed by Peters (1986) for Rock-Eval^2 were used in interpreting the data herein.

Figure 2. Part of core from Premium Homestead Akpatok F-26 well at Canada-Nova Scotia Offshore Petroleum Board Core Lab.

RESULTS

1) Total Organic Carbon (TOC), and free (S_1) and residual (S_2) hydrocarbons

The 41 samples have minimum and maximum TOC values of 0.14% and 0.93%, with an average of 0.38%; minimum and maximum S_1 values of 0.04 and 1.2 mg HC/g rock, with an average of 0.23 mg HC/g rock; and minimum and maximum S_2 values of 0.07 mg HC/g and 2.61 mg HC/g rock, with an average of 0.58 mg HC/g rock (Fig. 3; Appendix 2). These indicate that the shales of Ship Point Formation would qualify as either poor or fair for petroleum source rock based on the criteria of Peters (1986) and Peters and Cassa (1994).

2) Temperature at S_2 peak (T_{max}) and Production Index (PI)

Petroleum generation requires T_{max} values of at least 435°C, up to 445°C, depending upon the kerogen type (Peters, 1986; Peters and Cassa, 1994). Samples with an S_2<0.2 mg HC/g rock are considered to produce unreliable T_{max} values.

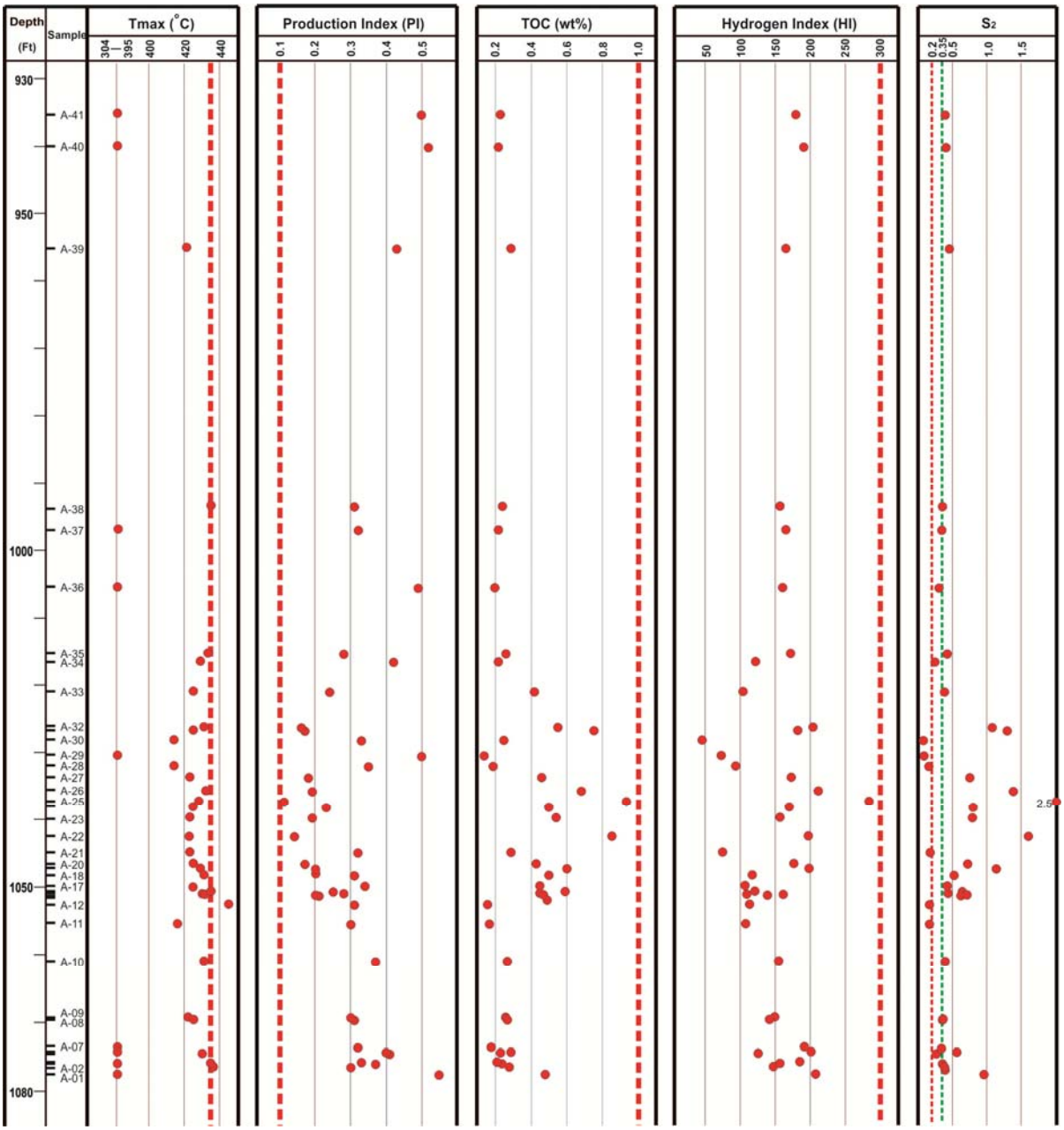

Figure 3. Selected Rock-Eval[6] pyrolysis parameters with depth for 41 core samples from Premium Homestead Akpatok F-26 well.

However, in the study of Dewing and Sanei (2009), the T_{max} of samples with $S_2 < 0.35$ were excluded from consideration as valid thermal maturity points. Taking both as guideline, 35 and 30 out of 41 samples are with $S_2 > 0.2$ mg HC/g rock (highlighted by both grey and yellow in Appendix 2) and $S_2 \geq 0.35$ mg HC/g rock (highlighted by

yellow in Appendix 2), respectively (Fig. 3); therefore, based on these criteria the T_{max} values from majority of samples are reliable and can be used in evaluating thermal maturity.

The T_{max} values of the 35 out of 41 samples, with S_2>0.2 mg HC/g rock, range from 304°C to 436°C, with an average of 406°C; the T_{max} values of the 30 out of 41 samples, with $S_2 \geq 0.35$ mg HC/g rock, also range from 304°C to 436°C, but with an average of 410.6°C, among which four samples range from 435°C to 436°C (Fig. 3; Appendix 2).

From the pyrograms of the 41 samples (Appendix 3), only 12 (Akpatok-013, 014, 019, 020, 022, 023, 024, 025, 026, 027, 031, 032) and possibly another three samples (Akpatok-09, 015, 016) have really sharp and clean S_2 peak, and relatively sharp and clean S_2 peak, respectively. Among these 15 samples, the T_{max} values range from 422°C to 435°C with an average of 427.5°C.

Therefore, basically these samples are still outside of the window for petroleum generation. However, this seems inconsistent with PI values, another parameter indicating the amount of in-situ hydrocarbon generation and describing level of thermal maturation. A PI value of 0.1 is considered to be the minimum value to indicate oil generation (Peters, 1986; Peters and Cassa, 1994). The PI values for the 41 samples range from 0.11 to 0.55 (Fig. 3; Appendix 2), with an average of 0.31. Even using the pyrograms as a filter, the PI values among the 15 "valid" samples range from 0.11 to 0.3, with an average of 0.2. If based only on the PI values, all the samples would be within the window for petroleum generation; however, this could be caused by some unknown reasons (see discussion below).

3) Hydrogen Index (HI), ratio of S_2 to S_3 (S_2/S_3) and kerogen type

HI and S_2/S_3 are used to determine the organic matter type. HI > 600 and S_2/S_3 >15 are assigned to Type I kerogen; HI = 300–600 and S_2/S_3 = 10–15 to Type II kerogen; HI = 200–300 and S_2/S_3 = 5–10 to Type II/III kerogen; and HI = 50–200 and S_2/S_3 = 1–5 to Type III kerogen (Peters, 1986; Peters and Cassa, 1994). The HI values of 41 samples range between 28 and 281, with an average of 142, and the S_2/S_3 values range from 0.15 to 4.9, with an average of 1.27. Based on this, and the van Krevelen diagram (Fig. 4), the samples might contain Type III kerogen (see discussion below).

DISCUSSION

1) High PI and low S_1 and T_{max} values

As noted above, the T_{max} and PI values from this study are contradictory in the interpretation of thermal maturaty. It is questionable whether these samples are contaminated or affected by migrated oil, as for immature rocks (T_{max} less that about

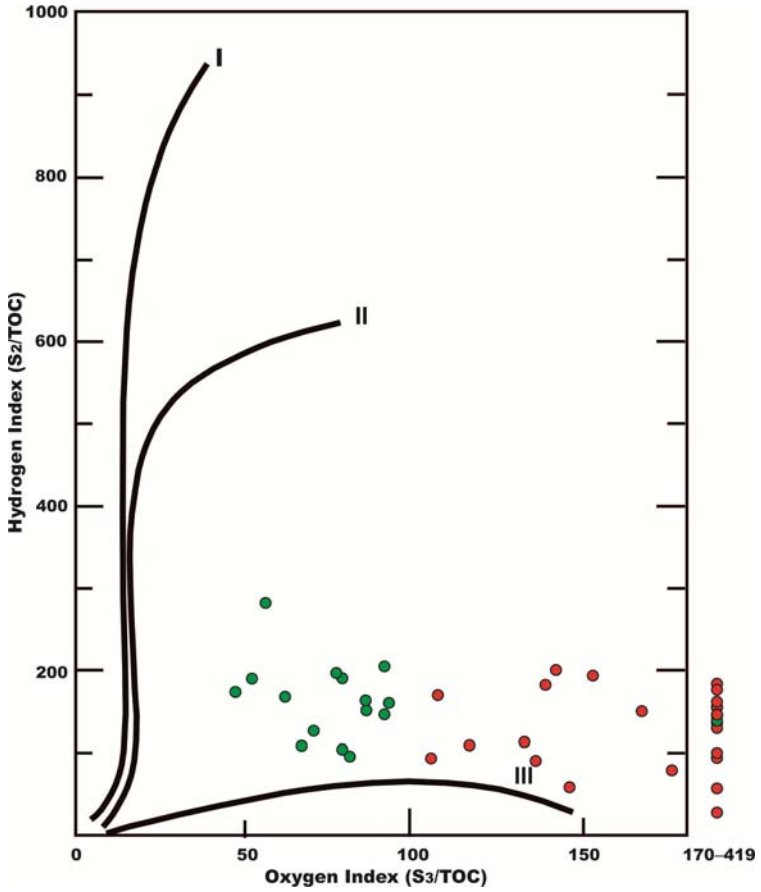

Figure 4. Modified van Krevelen diagram showing relationship between Hydrogen and Oxygen indices of all 41 samples from Premium Homestead Akpatok F-26 well. Green dots represent 15 samples with sharp and clean S_2 peak on pyrograms.

435°C), bimodal S_2 peaks and PI values over 0.2 may indicate contamination or migrated oil. Peter (1986) indicated that oil-based mud contamination or migrated oil is likely where PI or S_1/TOC is greater than 0.2 or 0.3. Among the 41 analyzed samples, for at least 26 samples, their pyrograms show bimodal S_2 peaks (Appendix 3); PI values range between 0.2 and 0.55 among 33 samples; and S_1/TOC values range between 0.32 and 2.50 among 38 samples. These could be an indication of contamination or migrated oil; however, pyrograms of contaminated rocks commonly show S_1 peak greater than 2 mg HC/g rock, an anomalously high PI, an low T_{max} (compared to adjacent samples) and a bimodal S_2 peaks (Peter, 1986). For the analyzed 41 samples, minimum and maximum S_1 values of 0.04 and 1.2 mg HC/g rock are found, with an average of 0.23 mg HC/g rock, which is much lower than 2 mg HC/g rock, the threshold of Peters (1986). Based on the low S_1 values, it is unsure if the contamination or migrated oil hypotheses could be put forward.

To compare Peter's (1986, table 4, fig. 13) data set where the contaminated sample is rare; from the data set of this study, almost all samples have abnormally high PI values against low S_1 and T_{max} values, and the pyrograms of 63% of the samples show bimodal S_2 peaks (Appendix 3). Therefore, more investigation is needed to determine whether contamination or migrated oil or something else caused the high PI and S_1/TOC values as well as bimodal S_2 peaks.

2) Kerogen type

Organic-lean samples containing less than about 0.5 wt. % TOC are most likely to be strongly affected by adsorption of pyrolyzate by the mineral matrix, resulting in reduced S_2 and HI (Peters, 1986). Therefore, the presence of Type III, based on HI and S_2/S_3 data from the 41 samples, is probably erroneous. Generally, Type III kerogen is derived from lignin in terrestrial plant matter. Based on conodont microfossils recovered from the Ship Point Formation in the Premium Homestead Akpatok F-26 well (Workum et al., 1976), the formation was formed in a marine environment. It is questionable how much terrestrial plant matter would have affected the kerogen type, because the earliest land plants appeared in the Middle Ordovician, about 475 million years ago (Wellman et al., 2003).

The samples of slightly organic limestone from surface exposures on Akpatok Island contain immature Type II kerogen (Macauley, 1987), which are stratigraphically above the samples of this study. However, it needs more testing, such as biomarker analyses, to verify if the organic rocks on Akpatok Island contain Type II or Type II-S kerogen. On Southampton Island, Macauley et al. (1990) and Zhang and Hefter (2009) reported that all the samples tested by biomarker analyses have pristane/phytane values of less than one, which may indicate that they were deposited under reducing hypersaline conditions where sulphur-rich Type II (Type II-S) organic matter might present. The hypersaline and ecologically stressed depositional environment is supported by the nature of microfossil conodonts in the specific source rock interval (Zhang and Hefter, 2009). This is an important aspect to consider, as Type II-S source rock will start to generate oil at lower activation temperature.

ACKNOWLEDGEMENTS

This study is financially supported by Canada-Nunavut Geoscience Office for data collection in 2008. Ross Stewart (Geological Survey of Canada (GSC)-Calgary) undertook Rock-Eval[6] sample preparation and analysis. Mary Jean Verrall and Nancy White (Canada-Nova Scotia Offshore Petroleum Board) assisted during core sampling. Denis Lavoie (GSC-Quebec) acted as scientific reviewer.

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Appendix 1. Details of sampling from Premium Homestead Akpatok F-26 well

Depth	Interval Description	Samples	Sample description	Sample Depth
1203'-1187'	Precambrian granite			
1187'-1162'	Arkoses			
1162'-1083'	no recovery			
1083'-1079' 2"	white-milky colour, fine grained quartz sandstone; the rock is not very consolidated, some part is like salt or sugar grains			
1079'2"-1068' 5"	dark green conglomarate in the bottom 1', gradually changed into grey coarse sandstone interbedded with thin layers of dark green shale	Akpatok-001	dark green shale	1077'6"
		Akpatok-002	dark green shale	1076' 6"
		Akpatok-003	dark green shale	1076
		Akpatok-004	dark green shale	1075' 9"
		Akpatok-005	dark green shale	1074' 7"
		Akpatok-006	dark green shale	1074' 3"
		Akpatok-007	dark green shale	1073' 7"
		Akpatok-008	dark green shale	1069' 7"
		Akpatok-009	dark green shale (calcareous?)	1069' 4"
1068' 5"-1064"	gray/greenish grey limestone			
1064' -1061	light grey sandstone			
1061'-1052'	grey limestone interbedded with calcareous dark grey or black shale	Akpatok-010	dark grey calcareous shale	1061
		Akpatok-011	dark grey calcareous shale	1055' 5"
		Akpatok-012	dark grey calcareous shale	1052' 6"
1052'-1032'	dark grey and black limestone interbedded with black shale and black calcareous shale	Akpatok-013	black shale	1051' 3"
		Akpatok-014	black shale	1051' 1"
		Akpatok-015	black shale	1050' 10"
		Akpatok-016	black shale	1050' 7"
		Akpatok-017	black shale	1049' 9"
		Akpatok-018	black shale	1048' 2"
		Akpatok-019	black shale	1047' 3"
		Akpatok-020	black shale	1046' 5"
		Akpatok-021	black shale	1044' 10"
		Akpatok-022	black shale	1042' 5"
		Akpatok-023	dark grey calcareous shale	1039' 8"
		Akpatok-024	dark grey calcareous shale	1038' 2"
		Akpatok-025	dark grey calcareous shale	1037' 4"
		Akpatok-026	dark grey calcareous shale	1035' 9"
		Akpatok-027	dark grey calcareous shale	1033' 8"
		Akpatok-028	dark grey calcareous shale	1032'
1032'-1019' 9"	light grey limestone/dolostone interbadded with grey sandstone, dark grey shale; fine lamination very well developed	Akpatok-029	dark green shale	1030' 5"
		Akpatok-030	black shale (or limestone)	1028' 2"
		Akpatok-031	black shale	1026' 8"
		Akpatok-032	black shale (or limestone)	1026' 4"
		Akpatok-033	dark green/black shale	1021
1019' 9"-1018'	greenish grey coarse sandstone			

Appendix 1. Continued

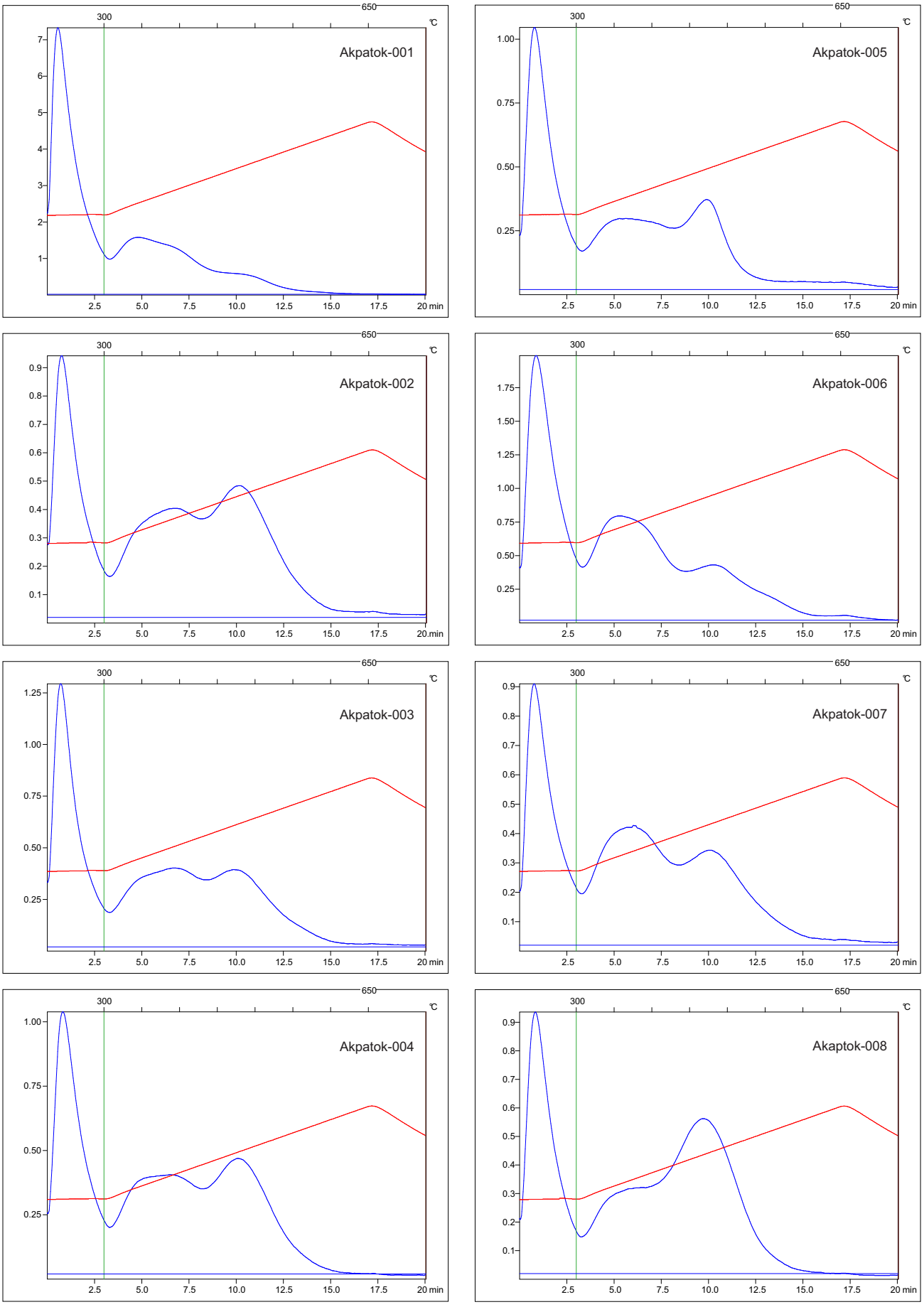
Depth	Interval Description	Samples	Sample description	Sample Depth
1018'-1012' 4"	Red coarse sandstone, greenish grey sandstone with grey limestone/dolostone layers and very thin green shale layers	Akpatok-034	dark green/black shale	1016' 5"
		Akpatok-035	dark green/black shale	1015' 4"
1012' 4"-1002'	light grey coarse to fine sandstone with a few thin layers of green shale; fine lamination very well developed	Akpatok-036	dark green shale	1005' 5"
1002' - 1000'	Red and grey coarse sandstone			
1000'-991' 6"	Light grey mid-fine sandstone, this with layers of green shale and dark redish grey limestone/dolostone	Akpatok-037	dark green shale	997'
		Akpatok-038	dark green shale	993' 5"
991' 6" - 990	Light grey coarse sandstone			
990' - 979'	no record			
979' -969'	Dark grey limestone/dolostone			
969' - 958'	Greenish grey coarse sandstone			
958' - 954'	Dark redish grey limestone/dolostone with very thin dark gray calareous shale	Akpatok-039	dark grey shale	955' 2"
954' - 935'	Greenish grey coarse-fine sandstone with dark grey limestone/dolostone and dark green shale	Akpatok-040	dark green shale	940'
		Akpatok-041	dark greenish grey shale	935' 2"

Appendix 2. Rock-Eval[6] data for 41 samples from Premium Homestead Akpatok F-26

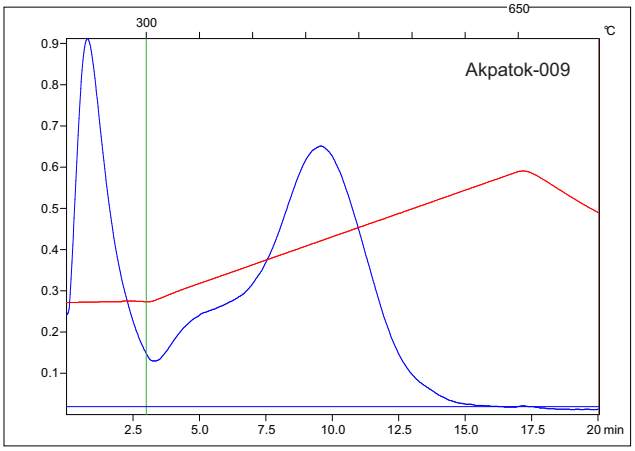
Sample	Qty (mg)	S_1	S_2	PI	S_3	Tmax	Tpeak	S_3CO	PC(%)	TOC	RC%
Akpatok-001	70.7	1.20	0.96	0.55	0.69	304	343	0.48	0.23	0.48	0.25
Akpatok-002	70.4	0.16	0.38	0.30	1.05	436	475	0.80	0.11	0.28	0.17
Akpatok-003	70.7	0.21	0.35	0.37	0.61	350	389	0.56	0.09	0.24	0.15
Akpatok-004	70.4	0.18	0.37	0.33	0.70	435	474	0.69	0.10	0.21	0.11
Akpatok-005	70.4	0.18	0.26	0.41	0.31	430	469	0.47	0.07	0.23	0.16
Akpatok-006	70.4	0.37	0.56	0.40	0.45	314	353	0.42	0.12	0.29	0.17
Akpatok-007	70.5	0.16	0.33	0.32	0.56	335	374	0.41	0.08	0.18	0.10
Akpatok-008	70.4	0.16	0.35	0.31	0.79	425	464	0.59	0.09	0.27	0.18
Akpatok-009	70.1	0.15	0.36	0.30	0.82	422	461	0.35	0.08	0.26	0.18
Akpatok-010	70.5	0.23	0.39	0.37	0.86	431	470	0.52	0.10	0.27	0.17
Akpatok-011	70.5	0.07	0.16	0.30	0.55	416	455	0.26	0.05	0.17	0.12
Akpatok-012	70.8	0.07	0.16	0.31	0.35	445	484	0.28	0.04	0.16	0.12
Akpatok-013	70.5	0.17	0.62	0.21	0.35	431	470	0.23	0.09	0.49	0.40
Akpatok-014	70.9	0.18	0.71	0.20	0.41	430	469	0.30	0.10	0.47	0.37
Akpatok-015	70.8	0.16	0.43	0.28	0.37	431	470	0.42	0.08	0.45	0.37
Akpatok-016	70.3	0.21	0.64	0.25	0.40	435	474	0.38	0.10	0.59	0.49
Akpatok-017	70.8	0.21	0.42	0.34	0.48	425	464	0.49	0.09	0.45	0.36
Akpatok-018	70.4	0.24	0.52	0.31	0.40	431	470	0.45	0.10	0.50	0.40
Akpatok-019	70.4	0.28	1.14	0.20	0.48	429	468	0.13	0.15	0.60	0.45
Akpatok-020	71.2	0.14	0.72	0.17	0.27	425	464	0.18	0.10	0.43	0.33
Akpatok-021	70.5	0.08	0.17	0.32	0.43	423	462	0.32	0.05	0.29	0.24
Akpatok-022	70.8	0.27	1.61	0.14	0.45	423	462	0.24	0.19	0.85	0.66
Akpatok-023	70.3	0.18	0.79	0.19	0.50	423	462	0.61	0.12	0.54	0.42
Akpatok-024	70.1	0.24	0.80	0.23	0.47	425	464	0.40	0.12	0.50	0.38
Akpatok-025	70.5	0.32	2.61	0.11	0.53	428	467	0.32	0.28	0.93	0.65
Akpatok-026	70.2	0.33	1.39	0.19	0.63	432	471	0.57	0.20	0.68	0.48
Akpatok-027	70.1	0.16	0.75	0.18	0.40	423	462	0.24	0.10	0.46	0.36
Akpatok-028	70.0	0.08	0.15	0.35	0.34	414	453	0.41	0.05	0.19	0.14
Akpatok-029	70.2	0.08	0.08	0.50	0.38	308	347	0.12	0.03	0.14	0.11
Akpatok-030	70.5	0.04	0.07	0.33	0.48	414	453	0.24	0.03	0.25	0.22
Akpatok-031	70.2	0.27	1.30	0.17	0.36	425	464	0.24	0.16	0.75	0.59
Akpatok-032	70.6	0.21	1.08	0.16	0.43	431	470	0.47	0.14	0.55	0.41
Akpatok-033	70.6	0.12	0.38	0.24	0.58	425	464	0.61	0.09	0.42	0.33
Akpatok-034	70.2	0.18	0.24	0.42	0.26	429	468	0.34	0.06	0.22	0.16
Akpatok-035	70.6	0.16	0.42	0.28	0.50	433	472	0.56	0.09	0.26	0.17
Akpatok-036	70.6	0.29	0.30	0.49	0.34	308	347	0.40	0.08	0.20	0.12
Akpatok-037	70.1	0.16	0.34	0.32	0.92	395	434	0.60	0.09	0.22	0.13
Akpatok-038	70.7	0.16	0.35	0.31	0.62	435	474	0.79	0.10	0.24	0.14
Akpatok-039	70.5	0.33	0.45	0.43	0.76	421	460	0.88	0.13	0.29	0.16
Akpatok-040	70.3	0.43	0.40	0.52	0.31	310	349	0.62	0.11	0.22	0.11
Akpatok-041	70.6	0.40	0.39	0.50	0.25	330	369	0.41	0.09	0.23	0.14

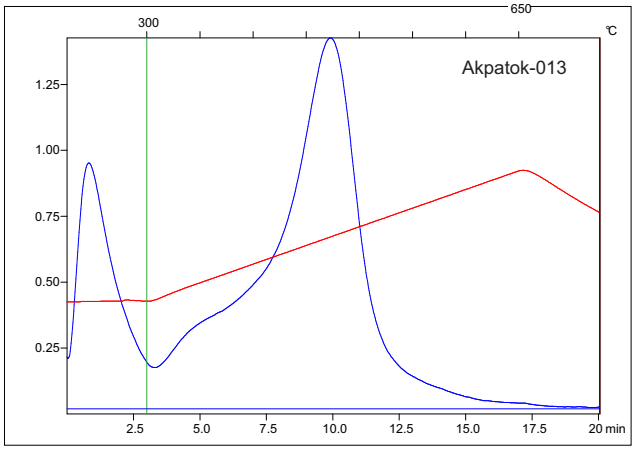
Appendix 2. Continued

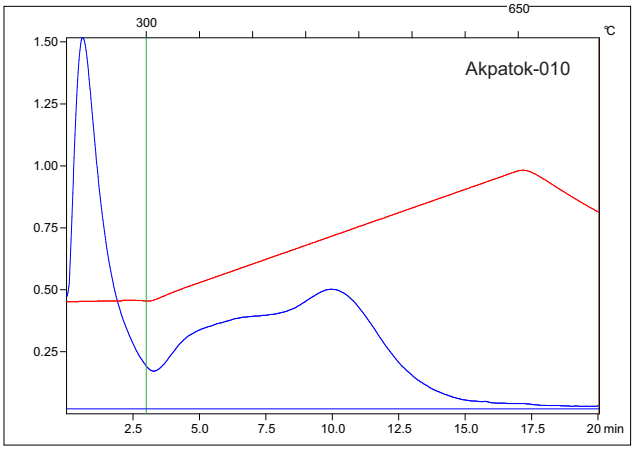
Sample	HI	OICO	OI	MINC%	S_4CO	S_4CO_2	RCCO(%)	S_4CO_2	S_5aCO_2	S_5bCO_2	KFID	$RCCO_2$(%)
Akpatok-001	200	100	144	1.2	1.1	7.2	0.050	0.0	0.0	0.0	1259	0.20
Akpatok-002	136	286	375	4.1	0.3	5.8	0.010	0.0	0.0	0.0	1259	0.16
Akpatok-003	146	233	254	0.8	0.2	5.2	0.010	0.0	0.0	0.0	1259	0.14
Akpatok-004	176	329	333	2.2	0.3	3.5	0.010	0.0	0.0	0.0	1259	0.10
Akpatok-005	113	204	135	0.4	0.9	4.5	0.040	0.0	0.0	0.0	1259	0.12
Akpatok-006	193	145	155	0.1	0.9	4.9	0.040	0.0	0.0	0.0	1259	0.13
Akpatok-007	183	228	311	1.2	0.4	2.9	0.020	0.0	0.0	0.0	1259	0.08
Akpatok-008	130	219	293	4.1	0.2	6.1	0.010	0.0	0.0	0.0	1259	0.17
Akpatok-009	138	135	315	5.4	0.3	6.1	0.010	0.0	0.0	0.0	1259	0.17
Akpatok-010	144	193	319	4.9	0.2	6.0	0.010	0.0	0.0	0.0	1259	0.16
Akpatok-011	94	153	324	6.8	0.1	4.5	0.000	0.0	0.0	0.0	1259	0.12
Akpatok-012	100	175	219	0.8	0.2	4.1	0.010	0.0	0.0	0.0	1259	0.11
Akpatok-013	127	47	71	0.2	2.0	11.5	0.090	0.0	0.0	0.0	1259	0.31
Akpatok-014	151	64	87	0.5	1.7	10.9	0.070	0.0	0.0	0.0	1259	0.30
Akpatok-015	96	93	82	0.3	1.8	10.6	0.080	0.0	0.0	0.0	1259	0.29
Akpatok-016	108	64	68	0.3	2.1	14.7	0.090	0.0	0.0	0.0	1259	0.40
Akpatok-017	93	109	107	3.6	1.1	11.5	0.050	0.0	0.0	0.0	1259	0.31
Akpatok-018	104	90	80	0.4	1.9	11.6	0.080	0.0	0.0	0.0	1259	0.32
Akpatok-019	190	22	80	2.6	2.0	13.4	0.090	0.0	0.0	0.0	1259	0.36
Akpatok-020	167	42	63	3.9	2.0	8.7	0.090	0.0	0.0	0.0	1259	0.24
Akpatok-021	59	110	148	1.6	0.8	7.3	0.040	0.0	0.0	0.0	1259	0.20
Akpatok-022	189	28	53	0.2	3.5	18.6	0.150	0.0	0.0	0.0	1259	0.51
Akpatok-023	146	113	93	0.8	2.0	12.2	0.090	0.0	0.0	0.0	1259	0.33
Akpatok-024	160	80	94	2.6	1.9	10.9	0.080	0.0	0.0	0.0	1259	0.30
Akpatok-025	281	34	57	2.1	3.6	18.3	0.150	0.0	0.0	0.0	1259	0.50
Akpatok-026	204	84	93	0.3	2.4	13.9	0.100	0.0	0.0	0.0	1259	0.38
Akpatok-027	163	52	87	1.8	1.9	10.1	0.080	0.0	0.0	0.0	1259	0.28
Akpatok-028	79	216	179	1.9	0.4	4.5	0.020	0.0	0.0	0.0	1259	0.12
Akpatok-029	57	86	271	0.1	0.5	3.3	0.020	0.0	0.0	0.0	1259	0.09
Akpatok-030	28	96	192	5.7	0.4	7.3	0.020	0.0	0.0	0.0	1259	0.20
Akpatok-031	173	32	48	0.3	3.6	15.8	0.160	0.0	0.0	0.0	1259	0.43
Akpatok-032	196	85	78	1.4	2.0	11.9	0.090	0.0	0.0	0.0	1259	0.32
Akpatok-033	90	145	138	3.8	0.7	10.9	0.030	0.0	0.0	0.0	1259	0.30
Akpatok-034	109	155	118	0.4	0.9	4.4	0.040	0.0	0.0	0.0	1259	0.12
Akpatok-035	162	215	192	3.7	0.3	5.7	0.010	0.0	0.0	0.0	1259	0.16
Akpatok-036	150	200	170	0.1	0.6	3.4	0.030	0.0	0.0	0.0	1259	0.09
Akpatok-037	155	273	418	0.9	0.1	4.7	0.000	0.0	0.0	0.0	1259	0.13
Akpatok-038	146	329	258	0.5	0.4	4.4	0.020	0.0	0.0	0.0	1259	0.12
Akpatok-039	155	303	262	1.8	0.3	5.7	0.010	0.0	0.0	0.0	1259	0.15
Akpatok-040	182	282	141	0.1	0.7	2.9	0.030	0.0	0.0	0.0	1259	0.08
Akpatok-041	170	178	109	0.1	0.7	4.0	0.030	0.0	0.0	0.0	1259	0.11

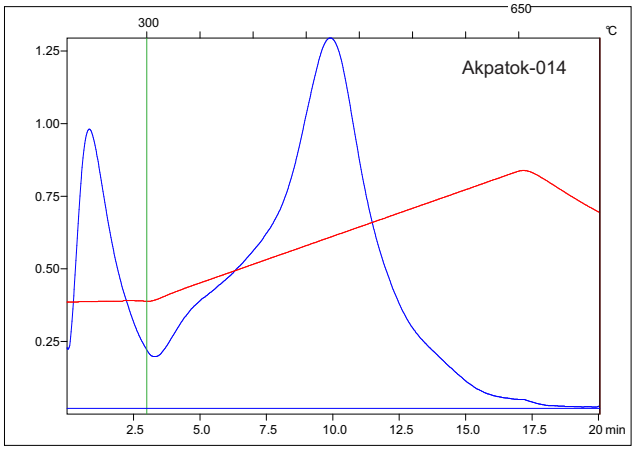


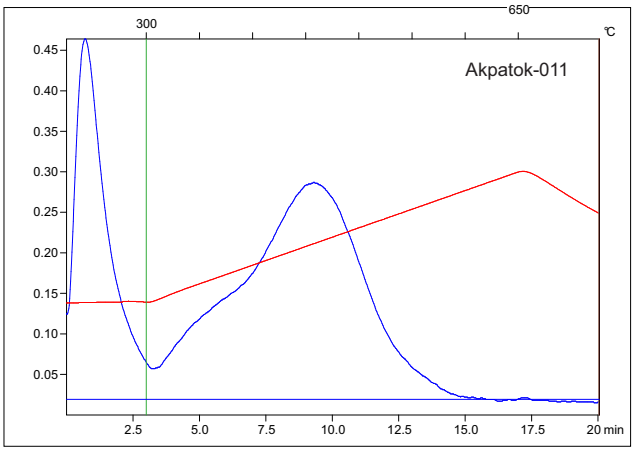
Appendix 3. Pyrograms of 41 samples from Premium-Homestead Akpatok F-26 well and one reference sample

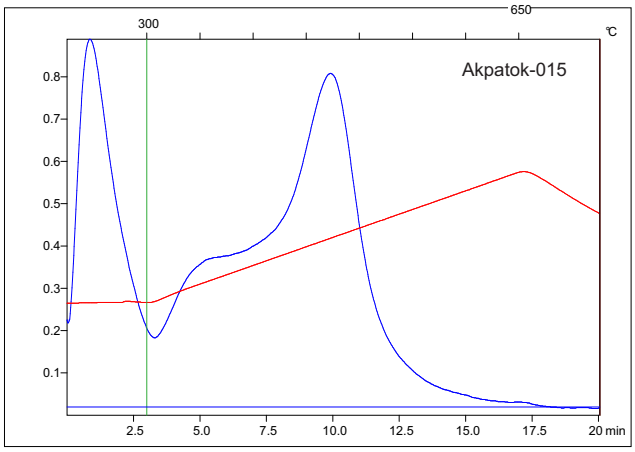


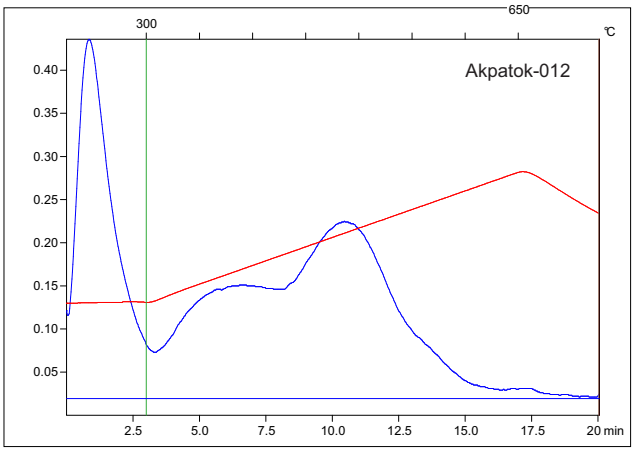


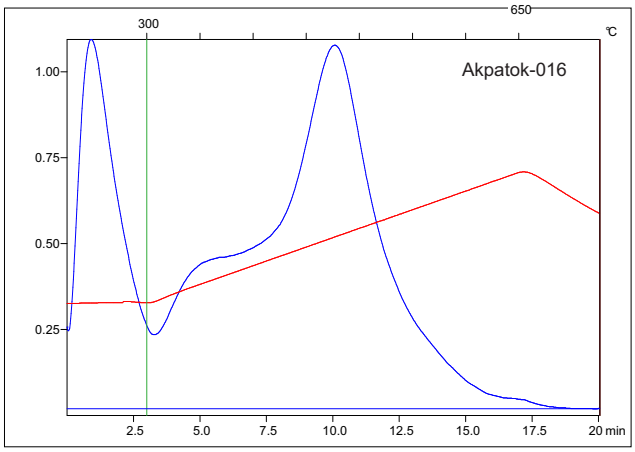




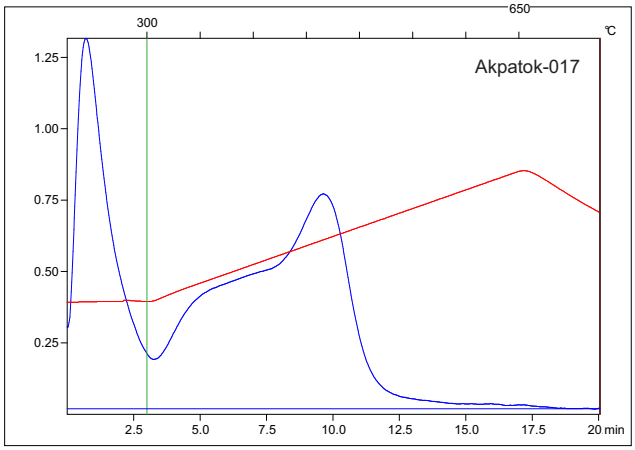


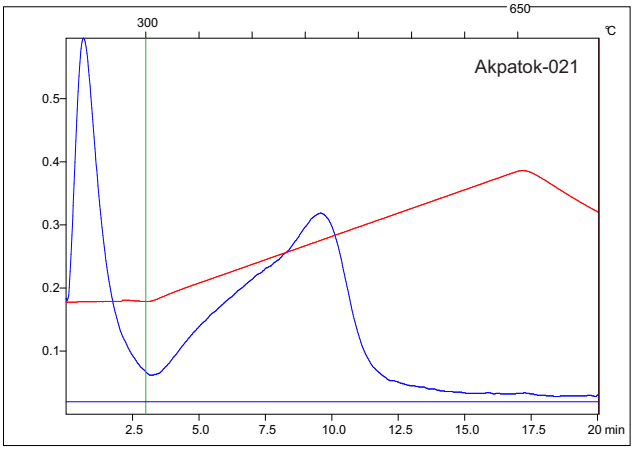


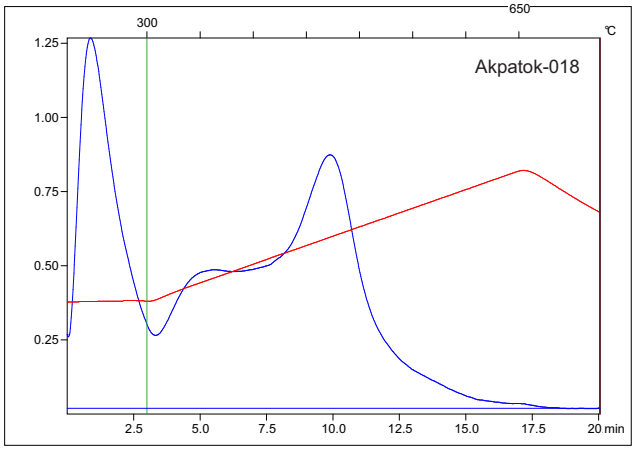


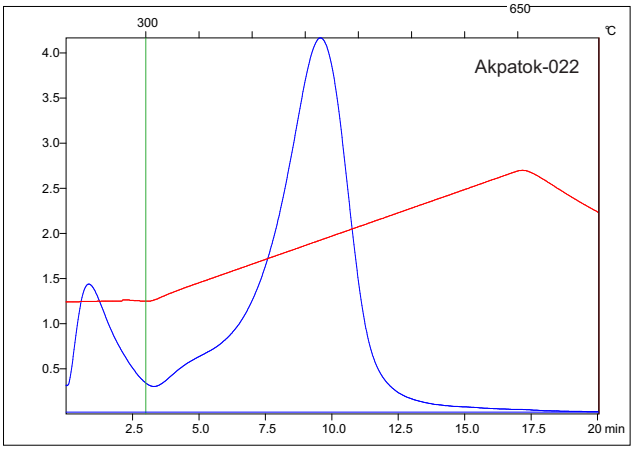


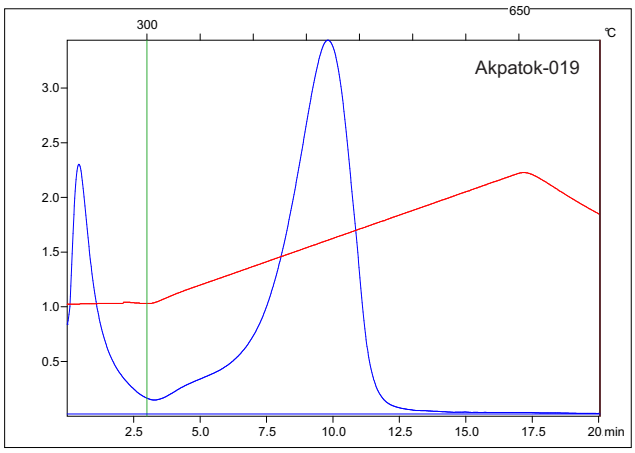
Appendix 3. Continued.

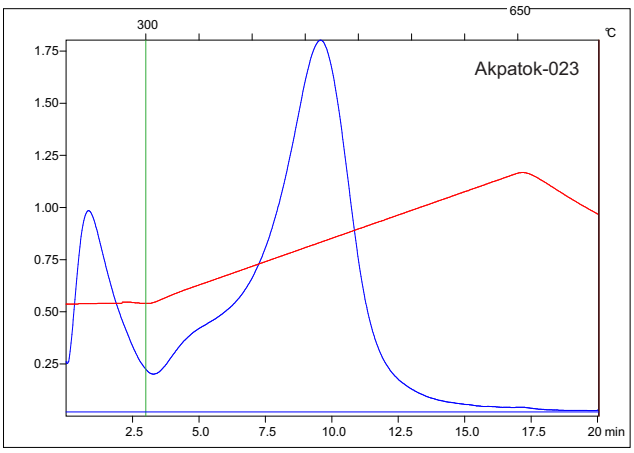


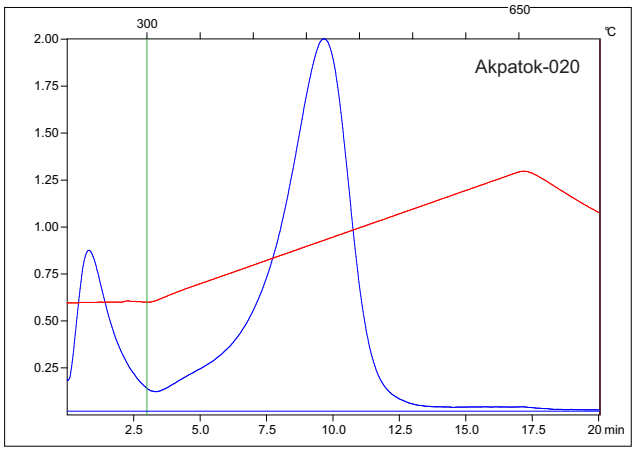


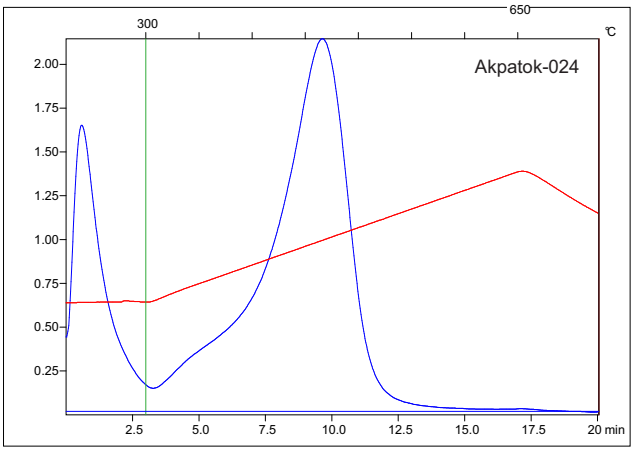




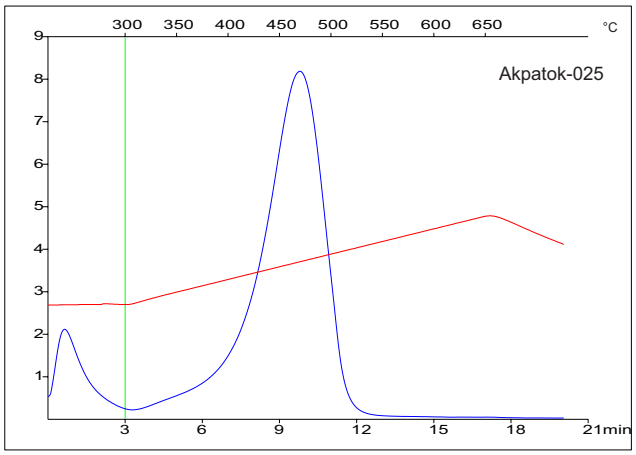


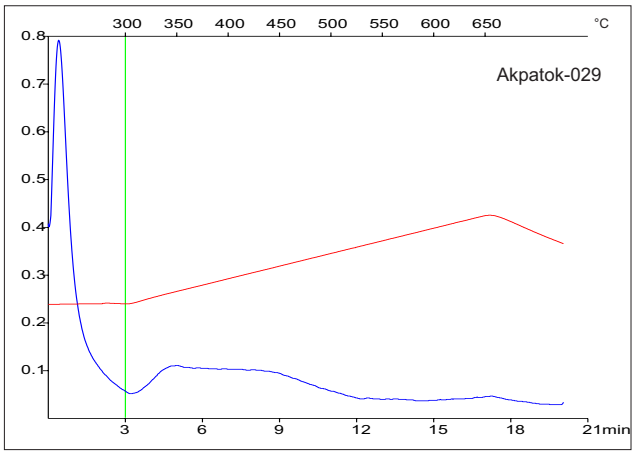


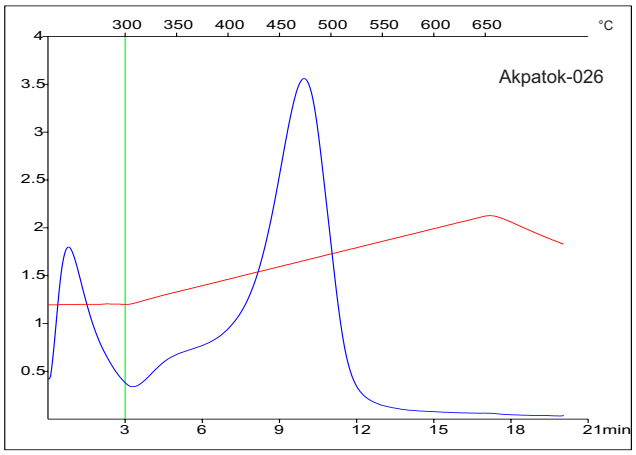


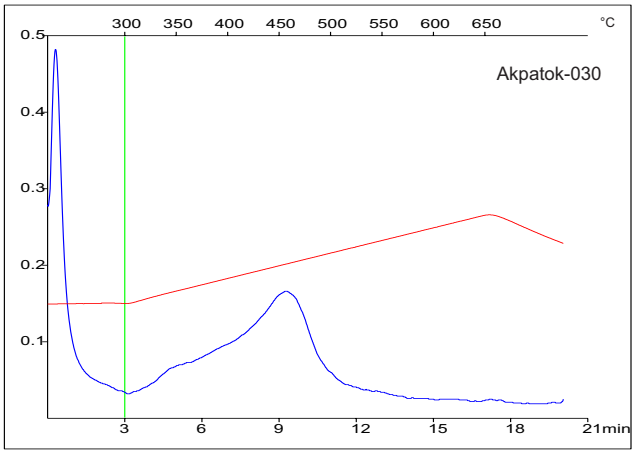


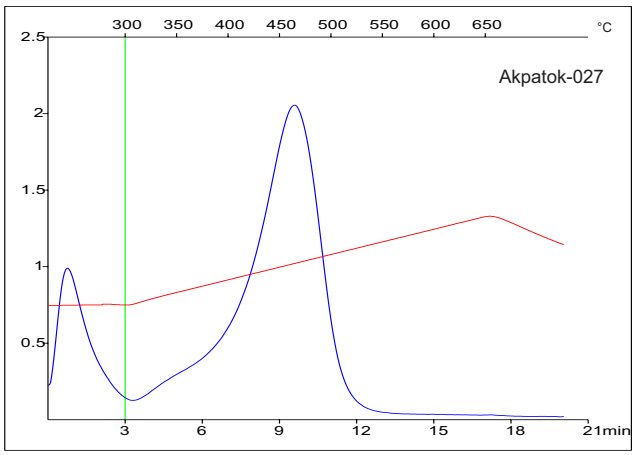
Appendix 3. Continued

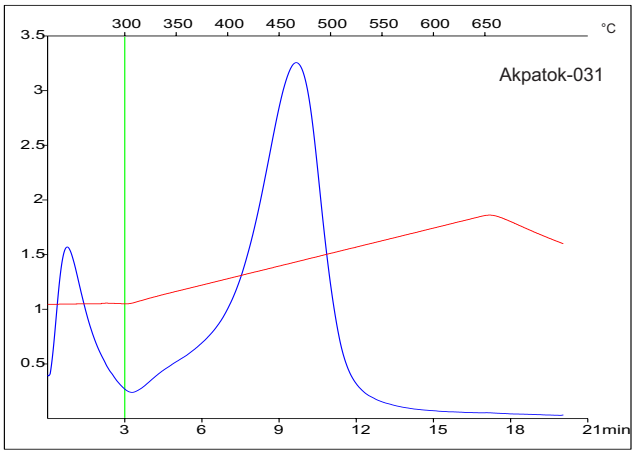


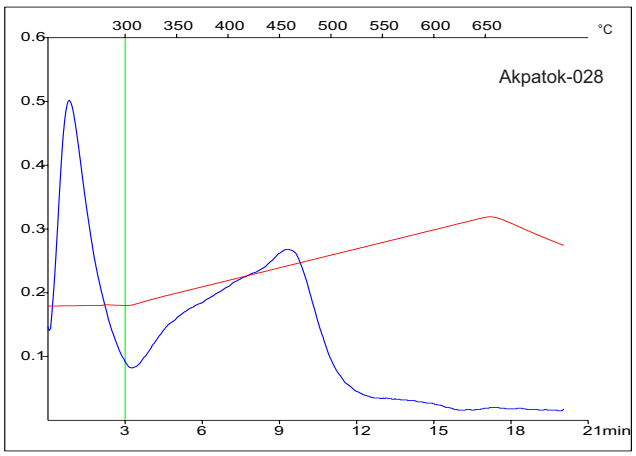


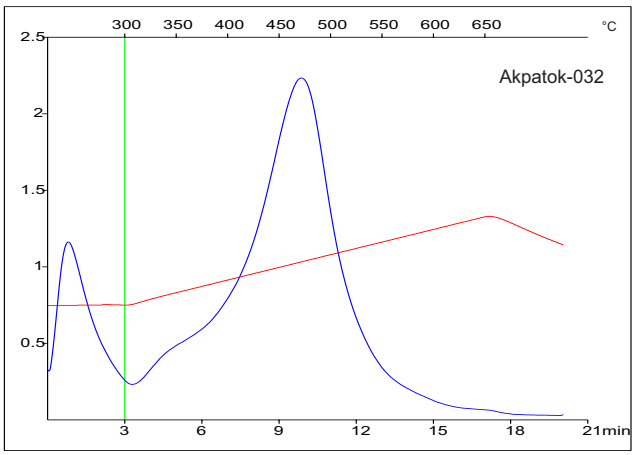




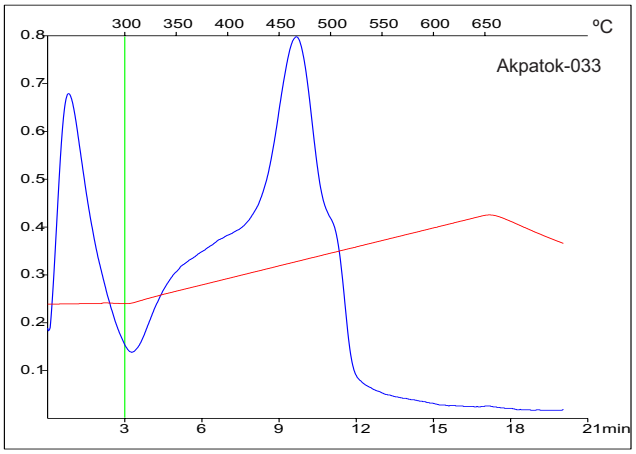


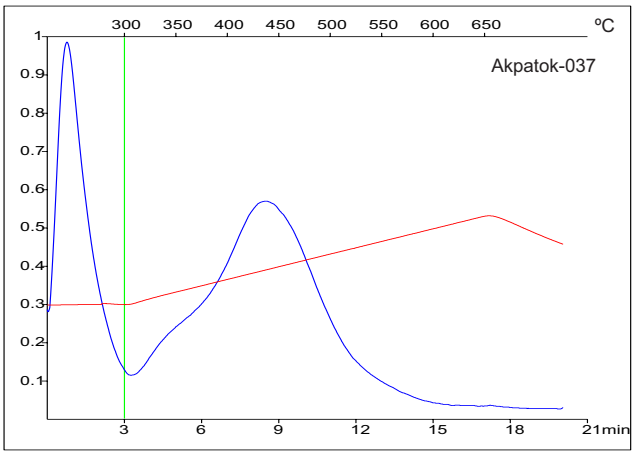


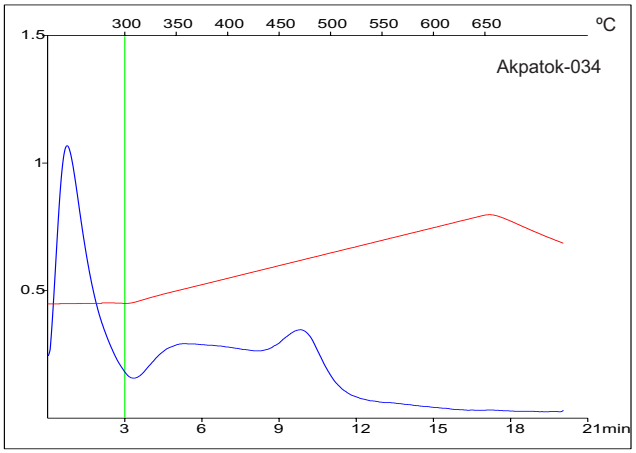


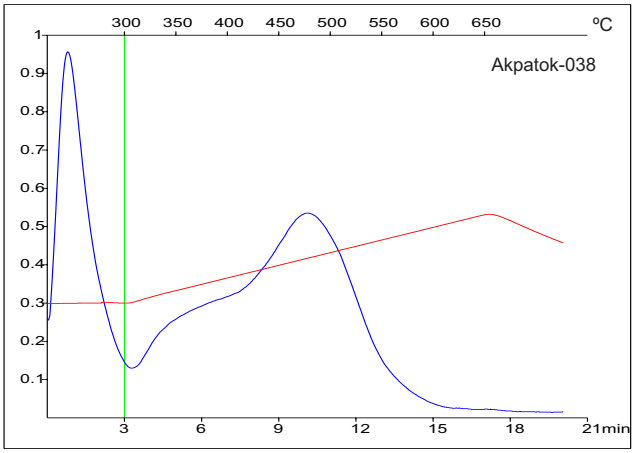


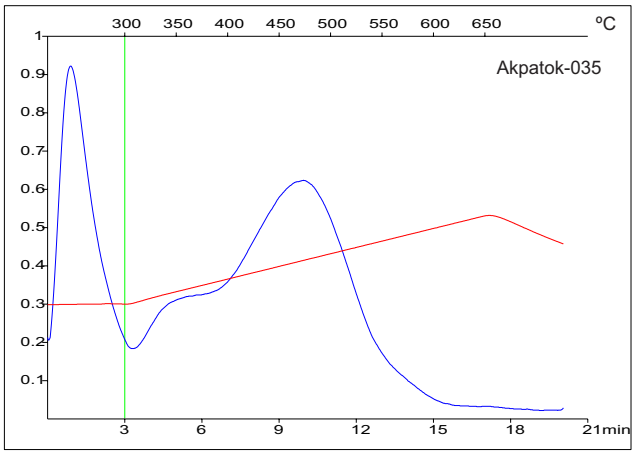
Appendix 3. Continued

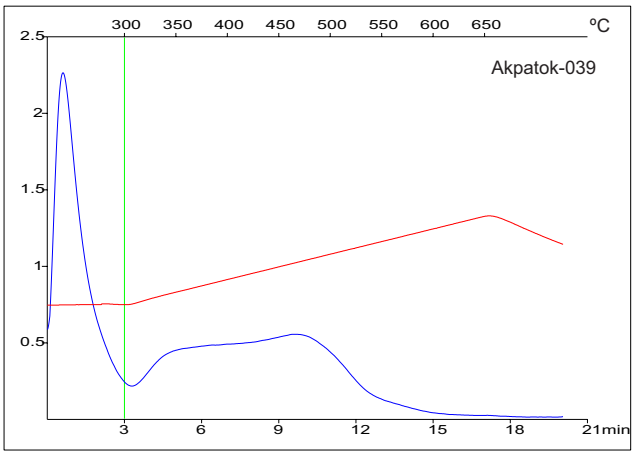


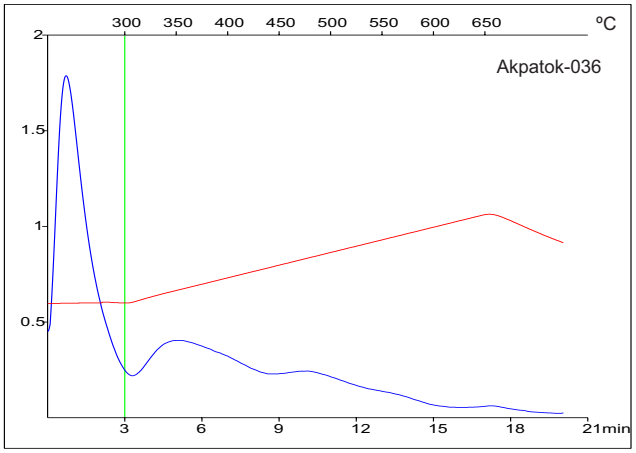


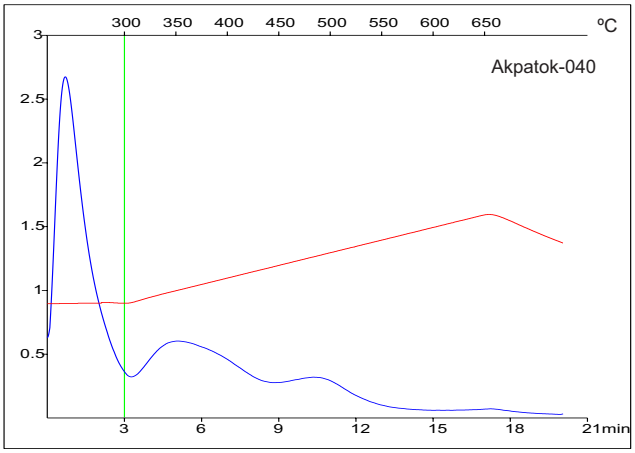




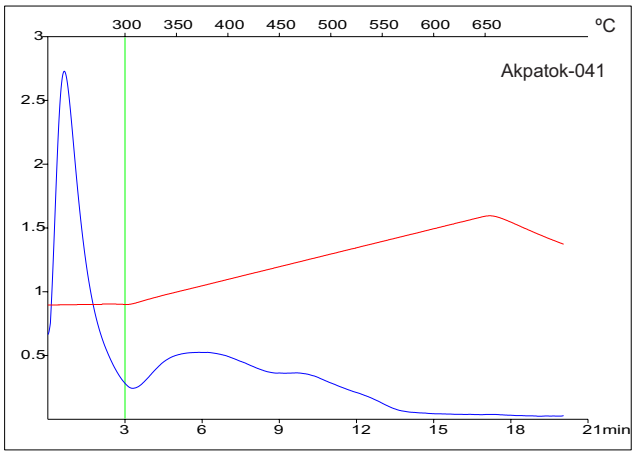








Appendix 3. Continued



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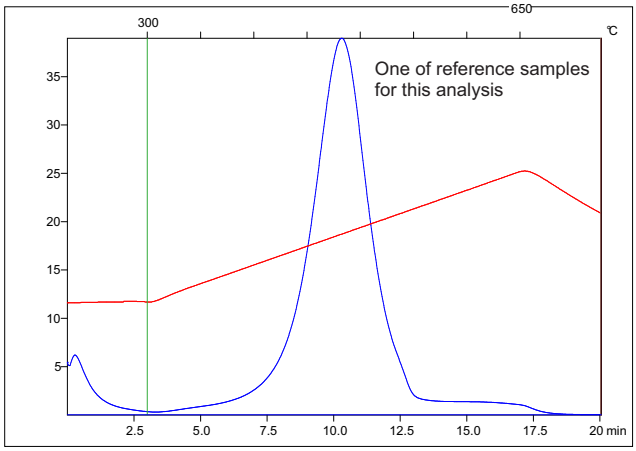
S2=11.92	Method =Bulk Rock
Tmax=441	Cycle=Basic
TpkS2=480.0	KFID(10*9)=1259
PI=0.06	Qty =70.5
HI=231	TOC(%)=5.15



Appendix 3. Continued