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ABSTRACT

A total of 134 samples collected from the dark-colored intervals of cores taken from oil and gas exploration wells in the Beaufort-Mackenzie Basin were analyzed using Rock-Eval/TOC technique. The aim of the project was to determine the petroleum source rock potential of selected Tertiary, Cretaceous and Jurassic intervals based on their organic richness, type of organic matter and their thermal maturity. This Rock-Eval reconnaissance will provide guidance for further oil-source correlation studies to better understand the petroleum systems in the Beaufort-Mackenzie Basin. Well cores were selected based on core description by Dixon (2002) and visual observation of the cores. Care has been taken to avoid intervals with possible drilling mud contamination.

Rock-Eval analytical results indicate that the Tertiary mudstone and coal measures contain immature to marginally mature Type III organic matter. TOC content of the Tertiary mudstone and shale sections can be as high as 5%. Its hydrocarbon potential is apparently lower than that of the Cretaceous and Jurassic rocks that appear to contain both Type III and Type II organic matter at similar or higher content. Thermal maturity of the Cretaceous and Jurassic potential source rocks ranges from marginally mature to over-mature, depending on their location in the basin. These results indicate that the Cretaceous and Jurassic source rocks have made significant contribution to oil and gas accumulations in the Beaufort-Mackenzie Basin.

INTRODUCTION

A multi-disciplinary study of petroleum systems of the Beaufort-Mackenzie Basin has been carried out at the Geological Survey of Canada under the Geo-Mapping for Energy and Minerals (GEM) Program since 2008. As part of this research, Rock-Eval analyses were performed on cuttings and core samples from key petroleum exploration wells across the basin to help constrain quantitative models of thermal history and petroleum generation, to define quality potential source rock intervals, and to conduct oil-source correlation studies to better understand the petroleum systems of the basin.

Geological recycling of organic matter is a common phenomenon in the Beaufort-Mackenzie region and therefore samples often contain multiple populations of organic macerals with different thermal maturity as evidenced from petrographic studies (Issler et al., 2012). Since significant and extensive oil migration and accumulation has occurred in the Tertiary sequences of Beaufort-Mackenzie Basin, oil impregnation may also be widespread, leading to "natural contamination" to the indigenous hydrocarbon signature of potential source rocks. This type of contamination commonly leads to increased Rock-Eval S2 values and lowered Tmax values. Although drilling-related mixing of sample material is unlikely for core samples, sample contamination by organic mud additives due to drilling mud invasion may affect material collected from core peripheral.

SAMPLES AND METHOD

A total of 134 shale, mudstone and coal samples were collected from the dark-colored sections of cores from 53 petroleum exploration wells drilled in the Beaufort-Mackenzie Basin. Selection of the samples was concentrated at intervals with high perceived source rock potential as evident from their lithology and color. Effort has been made to collect samples from all intersected sedimentary sections in the Beaufort-Mackenzie Basin including Permian, Jurassic, Cretaceous and Tertiary. Figure 1 shows the location of the well cores in this study, while Table 1 lists the samples collected and analyzed. Only 10 gram of rock material was allowed to be collected from each proposed core interval as per sampling permit issued by the National Energy Board (NEB). The collected samples were subjected to Rock-Eval analysis, and any further geochemical analysis would be determined based on the Rock-Eval/TOC results.

Rock-Eval analysis has been used extensively for petroleum source rock evaluation in geological basins by characterizing the organic richness, type of organic matter and thermal maturity of the sedimentary rocks. It is a thermal desorption and pyrolysis technique developed to measure the amount of hydrocarbons, CO and CO_2 released from a powdered rock sample upon heating treatment under inert gas flow. At the GSC-Calgary, typical Rock-Eval analysis of core and drilling cuttings samples is performed on a Rock-Eval 6 Turbo

device following the *Basic Method* as described by Lafrague *et al* (1998) and Behar *et al.* (2001). The Rock-Eval 6 Turbo is equipped with a flame ionization detector (FID) for monitoring the amounts of hydrocarbons, and an infra-red (IR) cell for monitoring the amounts of CO and CO_2.

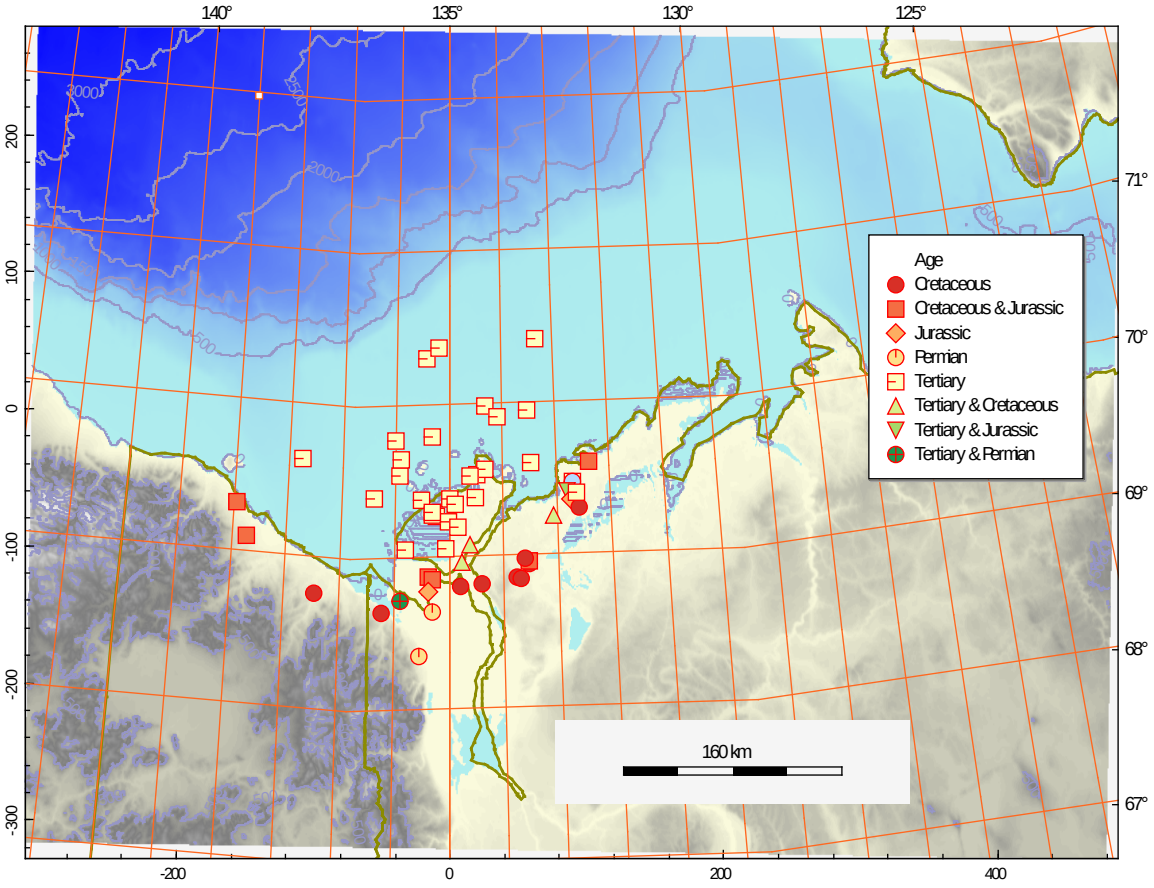

Figure 1. Location of Beaufort-Mackenzie Basin well cores in this study

Aliquots of about 70 mg of each powdered core sample were used in single Rock-Eval analysis. Initially samples are heated at 300°C for 3 minutes to volatilize any free hydrocarbons (HC) and these are represented by the Rock-Eval S1 peaks from the FID-pyrograms. Ideally, the area under the S1 pyrolysis curve (mg HC/g of initial rock) represents hydrocarbons naturally generated *in situ* over geologic time, but sample impregnation by migrated hydrocarbons, expulsion and loss of hydrocarbons, and organic drilling contaminants (e.g. oil-based drilling mud) can also affect the S1 values. Following this isothermal heating step, samples are heated linearly from 300°C to 650°C at a rate of

25°C/minute, yielding an S2 peak that represents thermal decomposition products from solid sedimentary organic matter, the kerogen. Under ideal conditions, the area under S2 curve (mg HC/g of initial rock) represents the remaining hydrocarbon potential of the rock sample at increased thermal maturity or deeper burial depths; however, the results can also be affected by the presence of heavy bitumen or oil impregnation due to oil migration and accumulation. The temperature at the maximum of S2 peak (TpS2) varies with the thermal maturity of the sedimentary organic matter, and is converted to Tmax (°C), the widely accepted thermal maturity parameter established on the older Rock-Eval 2 model. Similar to S2 peak value, the Tmax and TpS2 can also be affected by the presence of heavy hydrocarbons that often appears as a front shoulder (S2´ peak) to the S2 peaks.

The S3 curve corresponds to the amount of CO_2 (mg CO_2/g of initial rock) generated from organic matter during the initial isothermal heating step and the programmed heating phase up to 400°C. CO_2 generated between 400°C and 650°C is from the thermal decomposition of carbonate minerals. The Rock-Eval 6 instrument also records the amount of CO generated during pyrolysis and attributes various proportions to organic carbon and mineral sources depending on sample temperature (Behar *et al*., 2001 for details). The amount of pyrolysable or productive organic carbon (PC) is determined by combining the S1, S2, S3, CO_2 and CO contributions according to a pre-defined formula (Behar *et al*., 2001). Pyrolysis mineral carbon is determined from the high temperature portions of the CO and CO_2 pyrolysis curves.

Following pyrolysis, samples are transferred to an oxidation furnace of the Rock-Eval 6 instrument where they are linearly heated from 300°C to 850°C under air flow to determine the amount of residual organic carbon (RC) and oxidation mineral carbon from CO and CO_2 generated during oxidation. The total organic carbon (TOC) is the sum of the productive and residual organic carbon. Similarly, mineral carbon (MINC) is the sum of the pyrolysis and oxidation mineral carbon.

Other key Rock-Eval parameters included in this report are production index (PI = S1/(S1 + S2)), hydrogen index (HI = (S2x100)/TOC in mg HC/g TOC) and oxygen index (OI = (S3x100)/TOC in mg CO_2/g TOC). PI is often used as a thermal maturity indicator because

S1 and thus PI should increase with increasing maturation due to hydrocarbon generation. However, petroleum expulsion from a source rock at high maturation will result in lower S1 and PI values. In addition, a high PI may also indicate a pay zone due to oil accumulation. It should also be noted that S1 and PI values can be affected by drilling mud contamination. Plot of HI versus OI (Espitalié *et al*., 1977) has been used to determine the organic matter type and thermal maturity, and such plots are also included in this report. Sample contamination such as heavy bitumen impregnation, sample weathering and extremely low TOC content can affect both HI and OI values, therefore these results must be interpreted carefully. HI versus Tmax plots can also be used to examine organic maturation pathways in situations where OI values are anomalously high due to contributions from mineral carbon or other factors (Espitalié *et al*., 1984; Peters, 1986).

Peters (1986) discusses various factors that influence Rock-Eval parameters and presents guidelines for interpreting Rock-Eval data. For immature rocks, sample contamination (natural or drilling related) is indicated by multi-modal S2 peaks and PI values > 0.2. For TOC values < 0.5 wt%, pyrolysate adsorption on the mineral matrix can affect S1, S2 and Tmax values, an effect most significant for argillaceous rocks. While the presence of heavy hydrocarbons may lower the Tmax values, Peters (1986) suggests that Tmax values may not be reliable either when S2 values are less than 0.2 mg HC/g rock, although this criterion likely varies depending on the type of organic matter and rock matrix. For example, Obermajer *et al*. (2007) suggested a minimum S2 value of 0.35 mg HC/g rock for correctly interpreting Tmax values based on data from the Arctic Islands, and Riediger *et al*. (2004) used a value of 0.5 mg HC/g rock in their study of Triassic rocks from north-eastern British Columbia.

Table 1. Core samples collected from Beaufort-Mackenzie Basin for Rock-Eval analysis

GSC Sample ID	Well name	Latitude	Longitude	Depth (m)	Formation	Age	Lithology
C-560266	Adlartok P-09	69.647473	-137.760745	1774.60	Aklak	Tertiary	Mudstone
C-560267	Amerk O-09	69.982315	-133.517618	4374.40	Taglu	Tertiary	Mudstone
C-560268	Amerk O-09	69.982315	-133.517618	4606.60	Taglu	Tertiary	Mudstone
C-560269	Amerk O-09	69.982315	-133.517618	4862.00	Taglu	Tertiary	Mudstone
C-560270	Arluk E-90	70.323318	-135.446261	3449.00	Kugmallit	Tertiary	Mudstone
C-560271	Arluk E-90	70.323318	-135.446261	3937.60	Kugmallit	Tertiary	Mudstone
C-560272	Atertak E-41	69.507478	-132.704941	959.20	Aklak	Tertiary	Mudstone
C-560273	Atertak E-41	69.507478	-132.704941	1361.40	Aklak	Tertiary	Mudstone
C-560274	Atertak L-31 (K-31)	69.509535	-132.654772	2585.00	Mt Goodenough	Cretaceous	Mudstone
C-560275	Atigi G-04	68.887681	-133.770264	1915.10	Arctic Red	Cretaceous	Mudstone
C-560276	Atigi G-04	68.887681	-133.770264	2313.50	Arctic Red	Cretaceous	Mudstone
C-560277	Atigi G-04	68.887681	-133.770264	2721.10	Mt Goodenough	Cretaceous	Mudstone
C-560278	Atigi G-04	68.887681	-133.770264	2932.80	Kamik	Cretaceous	Mudstone
C-560279	Beaverhouse Creek H-13	68.371085	-135.553399	1483.40	Permian	Permian	Mudstone
C-560280	Blow River Yt. E-47	68.772047	-137.456292	615.55	Arctic Red	Cretaceous	Mudstone, black
C-560281	Blow River Yt. E-47	68.772047	-137.456292	1524.10	Arctic Red	Cretaceous	Mudstone, black
C-560282	Blow River Yt. E-47	68.772047	-137.456292	2267.63	Arctic Red	Cretaceous	Shale black
C-560283	Blow River Yt. E-47	68.772047	-137.456292	3052.10	Arctic Red	Cretaceous	Shale black
C-560284	Blow River Yt. E-47	68.772047	-137.456292	3969.20	Arctic Red	Cretaceous	Shale black
C-560285	Ellice O-14	69.065447	-135.807165	551.10	Taglu	Tertiary	Mudstone
C-560286	Ellice O-14	69.065447	-135.807165	1922.00	Taglu	Tertiary	Mudstone
C-560287	Ellice O-14	69.065447	-135.807165	2410.00	Aklak	Tertiary	Mudstone
C-560288	Fish River B-60	68.65069	-136.230116	2456.70	Arctic Red	Cretaceous	Mudstone, dark
C-560289	Fish River B-60	68.65069	-136.230116	2633.50	Mt. Goodenough	Cretaceous	Mudstone, dark
C-560290	Garry P-04	69.395971	-135.508184	3004.90	Taglu	Tertiary	Mudstone, dark
C-560291	Issungnak 2O-61	70.016662	-134.316334	2406.15	Kugmallit	Tertiary	Mudstone, brown
C-560292	Issungnak 2O-61	70.016662	-134.316334	3279.05	Kugmallit	Tertiary	Mudstone, brown
C-560293	Itiyok I-27	69.944387	-134.091531	1838.80	Kugmallit	Tertiary	Mudstone, brown
C-560296	Ivik K-54	69.559948	-134.486412	2922.50	Richards Seq	Tertiary	mudstone
C-560294	Ivik J-26	69.59495	-134.34669	3117.10	Richards Seq.	Tertiary	mudstone
C-560295	Ivik J-26	69.59495	-134.34669	3468.90	Richards Seq.	Tertiary	mudstone
C-560297	Kadluk O-07	69.780003	-136.024157	1494.40	Kugmallit	Tertiary	Mudstone
C-560298	Kadluk O-07	69.780003	-136.024157	1749.85	Kugmallit	Tertiary	mudstone
C-560299	Kimik D-29	69.634712	-132.372167	2332.50	Smoking Hills	Cretaceous	mudstone
C-560300	Kimik D-29	69.634712	-132.372167	2583.69	Husky	Jurassic	Black shale
C-560301	Kipnik O-20	68.833209	-134.807878	1797.75	Mt Goodenough	Cretaceous	Black shale
C-560302	Kopanoar 2I-44	70.395409	-135.206434	3760.87	Kugmallit	Tertiary	Mudtsone
C-560303	Kugmallit H-59	69.639275	-133.466364	1629.30	Kugmallit	Tertiary	Coal
C-560304	Kugmallit H-59	69.639275	-133.466364	1636.90	Kugmallit	Tertiary	Mudstone
C-560305	Kugmallit H-59	69.639275	-133.466364	1738.38	Kugmallit	Tertiary	Coal
C-560306	Kugmallit H-59	69.639275	-133.466364	1742.85	Kugmallit	Tertiary	Mudstone
C-560307	Kugmallit H-59	69.639275	-133.466364	1743.80	Kugmallit	Tertiary	Mudstone
C-560308	Kugpik L-24	68.891972	-135.372968	2012.25	Smoking Hills	Cretaceous	black shale
C-560309	Kugpik L-24	68.891972	-135.372968	2261.73	Husky	Jurassic	brown shale

Table 1. (Continued)

GSC Sample ID	Well name	Latitude	Longitude	Depth (m)	Formation	Age	Lithology
C-560310	Kugpik O-13	68.880445	-135.306826	1989.50	Smoking Hills	Cretaceous	bluish black shale
C-560311	Kugpik O-13	68.880445	-135.306826	2131.00	Smoking Hills	Cretaceous	dark grey shale
C-560312	Kugpik O-13	68.880445	-135.306826	2956.60	Husky	Jurassic	Mudstone
C-560313	Kumak E-58	69.291443	-135.251455	1132.55	Taglu	Tertiary	Coal
C-560314	Kumak E-58	69.291443	-135.251455	1137.80	Taglu	Tertiary	Mudstone
C-560315	Kumak J-06	69.259921	-135.018808	1368.90	Taglu	Tertiary	Shale
C-560316	Kumak J-06	69.259921	-135.018808	2308.12	Taglu	Tertiary	Coal
C-560317	Mallik A-06	69.416904	-134.507251	2641.90	Richards	Tertiary	Shale
C-560318	Mallik A-06	69.416904	-134.507251	2826.28	Richards	Tertiary	Shale
C-560319	Mallik A-06	69.416904	-134.507251	2943.80	Richards	Tertiary	Shale
C-560320	Mallik A-06	69.416904	-134.507251	3218.60	Taglu	Tertiary	Shale
C-560321	Mallik A-06	69.416904	-134.507251	3602.28	Taglu	Tertiary	Shale
C-560322	Mayogiak J-17	69.444975	-132.806179	2181.40	Aklak	Tertiary	dark grey shale
C-560323	Mayogiak J-17	69.444975	-132.806179	2699.90	Husky	Jurassic	Mudsatone
C-560324	Nerlerk J-67	70.444976	-133.327698	3959.85	Kugmallit	Tertiary	Mudstone
C-560325	Nerlerk J-67	70.444976	-133.327698	4355.30	Kugmallit	Tertiary	Mudstone
C-560326	Netserk B-44	69.550744	-135.935541	3303.05	Taglu	Tertiary	Mudstone
C-560327	Netserk F-40	69.656306	-135.908704	1859.45	Kugmallit	Tertiary	Mudstone
C-560328	Niglintgak B-19	69.302971	-135.308043	895.25	Taglu	Tertiary	Mudstone
C-560329	Niglintgak B-19	69.302971	-135.308043	1950.46	Taglu	Tertiary	Mudstone
C-560330	Niglintgak M-19	69.313526	-135.326657	976.60	Taglu	Tertiary	Mudtsone
C-560331	Niglintgak M-19	69.313526	-135.326657	1296.70	Taglu	Tertiary	Mudtsone
C-560332	Nipterk L-19	69.81055	-135.334418	1321.20	Kugmallit	Tertiary	Mudstone
C-560333	Nipterk L-19	69.81055	-135.334418	1933.00	Kugmallit	Tertiary	Mudstone, grey
C-560334	Nipterk L-19	69.81055	-135.334418	2102.50	Kugmallit	Tertiary	Mudstone, grey
C-560335	Nipterk L-19	69.81055	-135.334418	2311.80	Kugmallit	Tertiary	Mudstone, grey
C-560336	Nipterk L-19	69.81055	-135.334418	2512.00	Kugmallit	Tertiary	Mudstone
C-560337	Ogruknang M-31	68.847717	-134.416698	4030.60	Martin Creek	Cretaceous	Mudstone
C-560338	Ogruknang M-31	68.847717	-134.416698	4031.79	Martin Creek	Cretaceous	Coal
C-560339	Ogruknang M-31	68.847717	-134.416698	4034.15	Martin Creek	Cretaceous	Coally Mudtsone
C-560340	Parsons F-09	68.974414	-133.532034	2855.26	Kamik	Cretaceous	Coal
C-560341	Parsons F-09	68.974414	-133.532034	2993.23	McGuire	Cretaceous	Mudstone
C-560342	Parsons L-43	68.87735	-133.70162	2776.65	Kamik	Cretaceous	Mudstone, dark
C-560343	Parsons L-43	68.87735	-133.70162	2856.90	Kamik	Cretaceous	Coaly Mudstone
C-560344	Parsons N-10	68.996749	-133.533263	2762.60	Kamik	Cretaceous	Mudstone
C-560345	Parsons N-10	68.996749	-133.533263	2845.40	McGuire	Cretaceous	Shale black
C-560346	Parsons N-10	68.996749	-133.533263	2897.38	Husky	Jurassic	Shale
C-560347	Pikiolik E-54	69.387475	-132.745789	2687.95	Husky	Jurassic	Mudstone
C-560348	Pikiolik E-54	69.387475	-132.745789	2703.20	Husky	Jurassic	Shale
C-560349	Pikiolik G-21	69.33981	-132.598173	1316.25	Smoking Hills	Cretaceous	Shale
C-560350	Pikiolik M-26	69.431922	-132.626618	708.12	Aklak	Tertiary	Mudstone
C-560351	Pikiolik M-26	69.431922	-132.626618	864.75	Aklak	Tertiary	Mudstone, grey
C-560352	Reindeer D-27	69.101307	-134.617705	1129.30	Aklak	Tertiary	Coal seams
C-560353	Reindeer D-27	69.101307	-134.617705	2021.00	Aklak	Tertiary	Mudstone
C-560354	Reindeer D-27	69.101307	-134.617705	2723.50	Aklak	Tertiary	Mudstone
C-560355	Reindeer D-27	69.101307	-134.617705	3157.00	Fish River	Cretaceous	Mudstone

Table 1. (Continued)

GSC Sample ID	Well name	Latitude	Longitude	Depth (m)	Formation	Age	Lithology
C-560356	Reindeer D-27	69.101307	-134.617705	3313.62	Arctic Red	Cretaceous	Shale black
C-560357	Reindeer D-27	69.101307	-134.617705	3481.50	Arctic Red	Cretaceous	Shale dark grey
C-560358	Reindeer D-27	69.101307	-134.617705	3623.35	Arctic Red	Cretaceous	Shale, balck
C-560359	Reindeer D-27	69.101307	-134.617705	3798.50	Arctic Red	Cretaceous	Shale black
C-560360	Roland Bay YT L-41	69.341675	-138.951327	671.50	Boundary Creek	Cretaceous	Shale, black
C-560361	Roland Bay YT L-41	69.341675	-138.951327	679.60	Boundary Creek	Cretaceous	Shale, black
C-560362	Roland Bay YT L-41	69.341675	-138.951327	980.20	Mt Goodenough	Cretaceous	Shale, dark grey
C-560363	Roland Bay YT L-41	69.341675	-138.951327	1281.40	Mt Goodenough	Cretaceous	Shale
C-560364	Roland Bay YT L-41	69.341675	-138.951327	1586.42	Kingak Fm.	Jurassic	Shale, black
C-560365	Roland Bay YT L-41	69.341675	-138.951327	1892.00	Kingak Fm.	Jurassic	Shale, black
C-560366	Roland Bay YT L-41	69.341675	-138.951327	2206.16	Kingak Fm.	Jurassic	Shale, black
C-560367	Sarpik B-35	69.401837	-136.388934	2849.37	Aklak	Tertiary	Mudstone
C-560368	Siku E-21	69.008079	-133.617961	2865.83	Kamik	Cretaceous	Mudtosne, black
C-560369	Siku E-21	69.008079	-133.617961	3047.50	Kamik	Cretaceous	Mudtosne, black
C-560370	Spring River YT N-58	69.131201	-138.737439	600.70	Mt Goodenough	Cretaceous	Mudstone, drak
C-560371	Spring River YT N-58	69.131201	-138.737439	1343.02	Kingak	Jurassic	Mudstone, dark
C-560372	Spring River YT N-58	69.131201	-138.737439	1649.32	unknown	Jurassic	Shale, black
C-560373	Taglu D-55	69.403819	-134.995564	2903.60	Richards	Tertiary	Mudstone
C-560374	Taglu D-55	69.403819	-134.995564	3210.20	Taglu	Tertiary	Mudstone
C-560376	Taglu G-33	69.371573	-134.896311	951.30	Kugmallit	Tertiary	Coal seams
C-560375	Taglu G-33	69.371573	-134.896311	952.10	Kugmallit	Tertiary	Mudstone
C-560377	Taglu G-33	69.371573	-134.896311	2074.14	Richards	Tertiary	Mudstone, grey
C-560378	Taglu G-33	69.371573	-134.896311	2461.70	Richards	Tertiary	Shale, grey
C-560379	Taglu G-33	69.371573	-134.896311	2601.80	Taglu	Tertiary	Mudstone
C-560380	Titalik O-15	69.082686	-135.056038	1908.62	Taglu	Tertiary	Mudstone, grey
C-560381	Titalik O-15	69.082686	-135.056038	2824.50	Aklak	Tertiary	Mudstone
C-560382	Toapolok H-24	69.221589	-134.84302	1643.30	Taglu	Tertiary	Coal
C-560383	Toapolok H-24	69.221589	-134.84302	2148.75	Taglu	Tertiary	Mudstone
C-560384	Tuk F-18	69.291363	-133.069685	1729.30	Aklak	Tertiary	Mudstone, grey
C-560385	Tuk F-18	69.291363	-133.069685	2182.80	Aklak	Tertiary	Mudstone
C-560386	Tuk F-18	69.291363	-133.069685	2457.30	Smoking Hills	Cretaceous	Shale, dark grey
C-560387	Tuk F-18	69.291363	-133.069685	2789.40	Mt. Goodenough	Cretaceous	Shale, dark grey
C-560388	Tuk F-18	69.291363	-133.069685	2884.50	Mt. Goodenough	Cretaceous	Shale, dark grey
C-560389	Tununuk K-10	68.995467	-134.778786	898.53	Aklak	Tertiary	Mudstone, grey
C-560390	Tununuk K-10	68.995467	-134.778786	2824.42	Arctic Red	Cretaceous	Mudstone, black
C-560391	Tununuk K-10	68.995467	-134.778786	3357.60	Arctic Red	Cretaceous	Mudstone, black
C-560392	Tununuk K-10	68.995467	-134.778786	3708.50	Arctic Red	Cretaceous	Mudstone, black
C-560393	Ulu A-35	68.733755	-135.88511	1721.00	Fish River	Cretaceous	Mudstone, dark
C-560394	Ulu A-35	68.733755	-135.88511	1874.01	Fish River	Cretaceous	Mudstone, dark
C-560395	Ulu A-35	68.733755	-135.88511	2941.95	Permian	Permian	Mudstone, dark
C-560396	Unak B-11	68.669209	-135.313813	2898.20	Permian	Permian	Mudstone, black
C-560397	Unak L-28	68.79388	-135.371025	3258.82	Husky	Jurassic	Mudstone, grey
C-560398	Unark L-24	69.558334	-134.6195	2735.63	Kugmallit	Tertiary	Mudstone
C-560399	Unark L-24	69.558334	-134.6195	3766.30	Taglu	Tertiary	Mudstone

Table 2. Rock-Eval results for the cores samples from Beaufort-Mackenzie Basin

GSC Sample ID	Well name	Depth (m)	Formation	TOC (%)	Tmax (°C)	S1	S2	S3	PI	HI	OI	MINC%	PC (%TOC)	RC (%TOC)
C-560266	Adlartok P-09	1774.60	Aklak	1.53	430	0.39	1.49	7.68	0.21	97	502	0.90	25.5	74.5
C-560267	Amerk O-09	4374.40	Taglu	1.01	413	0.06	0.66	0.41	0.08	65	41	0.15	7.9	92.1
C-560268		4606.60	Taglu	1.10	430	0.12	0.65	0.21	0.16	59	19	0.13	7.3	92.7
C-560269		4862.00	Taglu	0.94	442	0.13	0.80	0.14	0.14	85	15	0.17	9.6	90.4
C-560270	Arluk E-90	3449.00	Kugmallit	1.43	428	0.56	1.46	4.14	0.28	102	290	0.35	20.3	79.7
C-560271		3937.60	Kugmallit	1.36	436	0.27	1.37	2.28	0.17	101	168	0.41	15.4	84.6
C-560272	Atertak E-41	959.20	Aklak	1.45	426	0.69	1.45	2.85	0.32	100	197	0.23	19.3	80.7
C-560273		1361.40	Aklak	1.48	422	1.60	1.79	2.12	0.47	121	143	0.22	24.3	75.7
C-560274	Atertak L-31	2585.00	Mt Goodenough	4.03	434	0.09	2.37	1.98	0.04	59	49	0.58	7.4	92.6
C-560275	Atigi G-04	1915.10	Arctic Red	1.67	419	0.13	1.00	0.42	0.12	60	25	0.18	7.2	92.8
C-560276		2313.50	Arctic Red	1.48	438	0.05	0.64	0.74	0.07	43	50	0.52	6.1	93.9
C-560277		2721.10	Mt Goodenough	0.74	443	0.03	0.40	0.26	0.08	54	35	0.52	6.8	93.2
C-560278		2932.80	Kamik	2.05	440	0.15	1.69	0.63	0.08	82	31	0.89	10.2	89.8
C-560279	Beaverhouse Creek H-13	1483.40	Permian	0.87	444	0.26	0.75	0.06	0.26	86	7	0.42	10.3	89.7
C-560280	Blow River Yt. E-47	615.55	Arctic Red	0.91	604	0.09	0.04	0.00	0.71	4	0	0.24	1.1	98.9
C-560281		1524.10	Arctic Red	1.50	330	0.10	0.10	0.05	0.50	7	3	0.36	1.3	98.7
C-560282		2267.63	Arctic Red	0.72	331	0.04	0.05	0.00	0.42	7	0	0.40	1.4	98.6
C-560283		3052.10	Arctic Red	0.79	309	0.03	0.03	0.00	0.50	4	0	0.21	1.3	98.7
C-560284		3969.20	Arctic Red	0.40	395	0.09	0.14	0.00	0.40	35	0	0.55	5.0	95.0
C-560285	Ellice O-14	551.10	Taglu	2.31	407	1.62	5.06	6.59	0.24	219	285	0.63	38.1	61.9
C-560286		1922.00	Taglu	1.89	436	0.05	0.99	4.17	0.05	52	221	0.48	11.6	88.4
C-560287		2410.00	Aklak	1.09	434	0.04	0.73	1.82	0.05	67	167	0.61	12.8	87.2

Table 2. (Continued)

GSC Sample ID	Well name	Depth (m)	Formation	TOC (%)	Tmax (°C)	S1	S2	S3	PI	HI	OI	MINC%	PC (%TOC)	RC (%TOC)
C-560288	Fish River B-60	2456.70	Arctic Red	0.88	470	0.10	0.45	0.14	0.19	51	16	0.20	5.7	94.3
C-560289		2633.50	Mt. Goodenough	1.69	474	0.20	0.72	0.23	0.22	43	14	0.31	5.3	94.7
C-560290	Garry P-04	3004.90	Taglu	1.49	430	0.25	1.37	3.18	0.16	92	213	1.24	19.5	80.5
C-560291	Issungnak 2O-61	2406.15	Kugmallit	1.06	428	0.06	0.70	5.02	0.08	66	474	0.24	20.8	79.2
C-560292		3279.05	Kugmallit	1.63	430	0.13	1.45	4.80	0.08	89	294	0.52	17.2	82.8
C-560293	Itiyok I-27	1838.80	Kugmallit	4.70	421	0.37	2.96	22.20	0.11	63	472	0.76	20.4	79.6
C-560296	Ivik K-54	2922.50	Richards Seq	1.19	431	0.07	0.74	6.35	0.09	62	534	0.28	21.0	79.0
C-560294	Ivik J-26	3117.10	Richards Seq.	1.26	429	0.05	0.86	6.06	0.06	68	481	0.53	20.6	79.4
C-560295		3468.90	Richards Seq.	1.06	431	0.09	0.60	4.03	0.12	57	380	0.45	17.0	83.0
C-560297	Kadluk O-07	1494.40	Kugmallit	1.57	430	0.14	1.18	9.19	0.10	75	585	0.40	24.2	75.8
C-560298		1749.85	Kugmallit	1.36	428	0.08	1.08	8.56	0.07	79	629	0.48	25.7	74.3
C-560299	Kimik D-29	2332.50	Smoking Hills	1.49	437	0.06	1.04	1.12	0.06	70	75	0.19	9.4	90.6
C-560300		2583.69	Husky	6.27	417	0.35	8.00	0.62	0.04	128	10	0.31	11.8	88.2
C-560301	Kipnik O-20	1797.75	Mt Goodenough	1.87	443	0.13	1.54	0.48	0.08	82	26	0.23	9.1	90.9
C-560302	Kopanoar 2I-44	3760.87	Kugmallit	1.36	433	0.26	1.30	5.34	0.17	96	393	0.42	21.3	78.7
C-560303	Kugmallit H-59	1629.30	Kugmallit	33.32	395	2.59	25.69	42.03	0.09	77	126	1.31	13.6	86.4
C-560304		1636.90	Kugmallit	3.07	403	0.58	2.38	3.87	0.20	78	126	0.38	14.3	85.7
C-560305		1738.38	Kugmallit	30.58	415	2.79	54.47	32.43	0.05	178	106	0.90	20.4	79.6
C-560306		1742.85	Kugmallit	22.63	413	3.55	63.32	23.49	0.05	280	104	0.64	29.0	71.0
C-560307		1743.80	Kugmallit	10.98	404	1.09	10.23	15.38	0.10	93	140	0.50	14.9	85.1
C-560308	Kugpik L-24	2012.25	Smoking Hills	2.79	429	0.67	4.05	0.38	0.14	145	14	0.47	15.1	84.9
C-560309		2261.73	Husky	5.84	448	1.07	8.34	0.45	0.11	143	8	0.74	14.0	86.0

Table 2. (Continued)

GSC Sample ID	Well name	Depth (m)	Formation	TOC (%)	Tmax (°C)	S1	S2	S3	PI	HI	OI	MINC%	PC (%TOC)	RC (%TOC)
C-560310	Kugpik O-13	1989.50	Smoking Hills	6.81	429	2.57	26.47	0.17	0.09	389	2	0.22	35.7	64.3
C-560311		2131.00	Smoking Hills	4.09	434	1.02	9.77	0.25	0.09	239	6	0.51	22.2	77.8
C-560312		2956.60	Husky	4.30	454	0.71	3.50	0.36	0.17	81	8	0.69	8.6	91.4
C-560313	Kumak E-58	1132.55	Taglu	50.36	409	6.21	66.79	56.14	0.09	133	111	1.58	17.0	83.0
C-560314		1137.80	Taglu	1.40	434	0.07	0.67	7.76	0.10	48	554	0.45	20.7	79.3
C-560315	Kumak J-06	1368.90	Taglu	6.07	412	0.85	4.72	5.71	0.15	78	94	0.89	12.4	87.6
C-560316		2308.12	Taglu	55.13	422	2.92	106.31	21.40	0.03	193	39	1.74	18.7	81.3
C-560317	Mallik A-06	2641.90	Richards	1.18	428	0.04	0.45	0.86	0.09	38	73	0.20	6.8	93.2
C-560318		2826.28	Richards	1.20	427	0.03	0.41	0.52	0.06	34	43	0.12	5.8	94.2
C-560319		2943.80	Richards	1.35	436	0.08	1.06	0.67	0.07	79	50	0.24	9.6	90.4
C-560320		3218.60	Taglu	0.57	441	0.03	0.30	0.71	0.08	53	125	0.97	14.0	86.0
C-560321		3602.28	Taglu	1.19	436	0.08	1.04	0.58	0.07	87	49	0.35	10.1	89.9
C-560322	Mayogiak J-17	2181.40	Aklak	1.41	433	0.16	1.00	3.78	0.14	71	268	0.70	15.6	84.4
C-560323		2699.90	Husky	1.79	437	0.44	1.71	0.35	0.20	96	20	0.24	11.2	88.8
C-560324	Nerlerk J-67	3959.85	Kugmallit	1.39	432	0.06	0.78	7.95	0.07	56	572	0.30	21.6	78.4
C-560325		4355.30	Kugmallit	1.37	430	0.05	0.74	12.97	0.06	54	947	0.64	31.4	68.6
C-560326	Netserk B-44	3303.05	Taglu	1.15	436	0.12	0.86	2.34	0.12	75	203	0.64	14.8	85.2
C-560327	Netserk F-40	1859.45	Kugmallit	1.57	420	0.04	0.64	2.70	0.06	41	172	0.24	10.2	89.8
C-560328	Niglintgak B-19	895.25	Taglu	1.49	435	0.08	0.67	7.57	0.11	45	508	0.68	19.5	80.5
C-560329		1950.46	Taglu	0.93	433	0.02	0.48	3.99	0.05	52	429	0.76	18.3	81.7
C-560330	Niglintgak M-19	976.60	Taglu	0.91	431	0.11	0.48	2.99	0.19	53	329	0.18	16.5	83.5
C-560331		1296.70	Taglu	3.07	427	3.89	3.74	9.28	0.51	122	302	0.47	30.0	70.0

Table 2. (Continued)

GSC Sample ID	Well name	Depth (m)	Formation	TOC (%)	Tmax (°C)	S1	S2	S3	PI	HI	OI	MINC%	PC (%TOC)	RC (%TOC)
C-560332	Nipterk L-19	1321.20	Kugmallit	1.74	412	1.35	1.04	2.52	0.57	60	145	0.15	17.2	82.8
C-560333		1933.00	Kugmallit	1.19	427	0.05	0.64	4.08	0.08	54	343	0.20	15.1	84.9
C-560334		2102.50	Kugmallit	1.27	428	0.07	0.94	5.85	0.07	74	461	0.18	20.5	79.5
C-560335		2311.80	Kugmallit	1.05	431	0.05	0.51	4.56	0.10	49	434	0.17	17.1	82.9
C-560336		2512.00	Kugmallit	1.05	429	0.05	0.72	6.90	0.07	69	657	0.72	25.7	74.3
C-560337	Ogruknang M-31	4030.60	Martin Creek	2.88	453	0.16	2.30	0.05	0.07	80	2	0.20	7.6	92.4
C-560338		4031.79	Martin Creek	81.72	459	5.30	166.07	3.61	0.03	203	4	0.61	17.9	82.1
C-560339		4034.15	Martin Creek	12.63	459	1.51	24.16	0.58	0.06	191	5	0.36	17.5	82.5
C-560340	Parsons F-09	2855.26	Kamik	2.01	438	0.21	2.47	0.37	0.08	123	18	0.28	12.9	87.1
C-560341		2993.23	McGuire	3.00	444	0.28	7.63	0.27	0.04	254	9	0.08	22.7	77.3
C-560342	Parsons L-43	2776.65	Kamik	1.68	446	0.11	1.63	0.69	0.06	97	41	0.73	11.3	88.7
C-560343		2856.90	Kamik	1.90	438	0.08	1.01	0.20	0.07	53	11	0.16	5.8	94.2
C-560344	Parsons N-10	2762.60	Kamik	2.33	432	0.32	4.00	0.19	0.07	172	8	0.05	16.3	83.7
C-560345		2845.40	McGuire	2.13	442	0.15	2.60	1.24	0.05	122	58	0.54	13.6	86.4
C-560346		2897.38	Husky	1.17	438	0.16	1.36	0.62	0.10	116	53	0.60	13.7	86.3
C-560347	Pikiolik E-54	2687.95	Husky	0.80	436	0.11	0.74	0.23	0.13	92	29	0.38	11.3	88.8
C-560348		2703.20	Husky	2.10	438	0.13	1.54	0.23	0.08	73	11	0.35	7.6	92.4
C-560349	Pikiolik G-21	1316.25	Smoking Hills	4.52	420	0.48	14.27	0.51	0.03	316	11	0.11	28.1	71.9
C-560350	Pikiolik M-26	708.12	Aklak	1.21	435	0.03	0.38	8.78	0.07	31	726	0.38	24.0	76.0
C-560351		864.75	Aklak	1.70	434	0.03	0.77	11.41	0.04	45	671	0.56	23.5	76.5

Table 2. (Continued)

GSC Sample ID	Well name	Depth (m)	Formation	TOC (%)	Tmax (°C)	S1	S2	S3	PI	HI	OI	MINC%	PC (%TOC)	RC (%TOC)
C-560352	Reindeer D-27	1129.30	Aklak	52.59	415	1.15	32.26	67.24	0.03	61	128	1.76	11.3	88.7
C-560353		2021.00	Aklak	2.15	431	0.17	2.29	5.76	0.07	107	268	0.67	18.1	81.9
C-560354		2723.50	Aklak	1.71	434	0.16	1.25	4.11	0.11	73	240	0.49	14.6	85.4
C-560355		3157.00	Fish River	0.98	443	0.06	0.58	0.56	0.10	59	57	0.62	8.2	91.8
C-560356		3313.62	Arctic Red	2.14	434	0.13	3.53	0.50	0.03	165	23	0.40	15.9	84.1
C-560357		3481.50	Arctic Red	1.47	443	0.19	2.02	0.04	0.08	137	3	0.23	12.9	87.1
C-560358		3623.35	Arctic Red	1.41	445	0.17	1.17	0.04	0.13	83	3	0.27	8.5	91.5
C-560359		3798.50	Arctic Red	1.12	447	0.36	0.76	0.12	0.32	68	11	0.18	9.8	90.2
C-560360	Roland Bay YT L-41	671.50	Boundary Creek	4.33	608	0.30	0.34	0.16	0.47	8	4	0.42	1.4	98.6
C-560361		679.60	Boundary Creek	3.20	606	0.13	0.28	0.46	0.32	9	14	0.95	1.6	98.4
C-560362		980.20	Mt Goodenough	1.16	310	0.26	0.26	0.02	0.50	22	2	0.18	4.3	95.7
C-560363		1281.40	Mt Goodenough	2.03	314	0.19	0.20	0.01	0.50	10	0	0.57	1.5	98.5
C-560364		1586.42	Kingak Fm.	2.71	303	0.32	0.12	0.05	0.73	4	2	0.46	1.5	98.5
C-560365		1892.00	Kingak Fm.	1.70	305	0.29	0.17	0.00	0.63	10	0	0.42	2.4	97.6
C-560366		2206.16	Kingak Fm.	1.20	306	0.18	0.14	0.00	0.56	12	0	0.21	2.5	97.5
C-560367	Sarpik B-35	2849.37	Aklak	2.25	433	0.16	1.81	4.38	0.08	80	195	0.95	13.8	86.2
C-560368	Siku E-21	2865.83	Kamik	2.45	432	0.32	3.41	0.28	0.08	139	11	0.85	14.7	85.3
C-560369		3047.50	Kamik	2.65	441	0.21	5.32	0.10	0.04	201	4	0.30	18.1	81.9
C-560370	Spring River YT N-58	600.70	Mt Goodenough	0.79	598	0.11	0.23	0.08	0.33	29	10	0.29	3.8	96.2
C-560371		1343.02	Kingak	0.58	499	0.04	0.07	0.00	0.37	12	0	0.21	1.7	98.3
C-560372		1649.32	unknown	1.94	499	0.06	0.10	0.00	0.36	5	0	0.54	0.5	99.5
C-560373	Taglu D-55	2903.60	Richards	1.26	429	0.07	0.68	0.29	0.09	54	23	0.13	6.3	93.7
C-560374		3210.20	Taglu	1.28	434	0.14	1.21	4.96	0.11	95	388	0.70	20.3	79.7

Table 2. (Continued)

GSC Sample ID	Well name	Depth (m)	Formation	TOC (%)	Tmax (°C)	S1	S2	S3	PI	HI	OI	MINC%	PC (%TOC)	RC (%TOC)
C-560376	Taglu G-33	951.30	Kugmallit	56.43	357	4.13	44.87	58.68	0.08	80	104	1.42	12.5	87.5
C-560375		952.10	Kugmallit	29.75	408	5.86	48.52	41.67	0.11	163	140	1.00	21.3	78.7
C-560377		2074.14	Richards	1.33	435	0.38	0.97	7.17	0.28	73	539	0.53	24.1	75.9
C-560378		2461.70	Richards	0.91	415	0.02	0.23	0.60	0.08	25	66	0.14	5.5	94.5
C-560379		2601.80	Taglu	1.14	429	0.12	0.92	2.95	0.11	81	259	0.85	16.7	83.3
C-560380	Titalik O-15	1908.62	Taglu	1.53	436	0.10	1.09	3.35	0.09	71	219	0.37	13.1	86.9
C-560381		2824.50	Aklak	0.95	445	0.07	0.63	0.37	0.10	66	39	0.30	7.4	92.6
C-560382	Toapolok H-24	1643.30	Taglu	48.28	420	0.99	80.78	37.67	0.01	167	78	1.29	17.8	82.2
C-560383		2148.75	Taglu	1.30	433	0.02	0.76	4.71	0.03	58	362	0.46	16.2	83.8
C-560384	Tuk F-18	1729.30	Aklak	1.35	432	0.02	0.54	7.60	0.04	40	563	0.70	20.7	79.3
C-560385		2182.80	Aklak	0.92	422	0.01	0.13	0.31	0.04	14	34	0.11	3.3	96.7
C-560386		2457.30	Smoking Hills	1.43	434	0.07	1.66	0.29	0.04	116	20	0.10	11.2	88.8
C-560387		2789.40	Mt. Goodenough	2.23	435	0.08	2.08	0.77	0.04	93	35	0.71	9.9	90.1
C-560388		2884.50	Mt. Goodenough	0.71	437	0.00	0.43	0.63	0.01	61	89	0.74	9.9	90.1
C-560389	Tununuk K-10	898.53	Aklak	0.84	435	0.02	0.28	0.18	0.07	33	21	0.04	4.8	95.2
C-560390		2824.42	Arctic Red	1.31	450	0.15	1.09	0.19	0.12	83	15	0.48	8.4	91.6
C-560391		3357.60	Arctic Red	1.00	463	0.07	0.41	0.00	0.16	41	0	0.29	4.0	96.0
C-560392		3708.50	Arctic Red	2.01	470	0.22	0.86	0.11	0.20	43	5	0.51	5.0	95.0
C-560393	Ulu A-35	1721.00	Fish River	1.71	436	0.10	1.12	0.25	0.08	65	15	0.25	7.0	93.0
C-560394		1874.01	Fish River	2.02	439	0.16	2.30	0.46	0.07	114	23	0.49	11.4	88.6
C-560395		2941.95	Permian	0.64	444	0.09	0.41	0.17	0.18	64	27	0.26	7.8	92.2
C-560396	Unak B-11	2898.20	Permian	1.01	448	0.05	0.43	0.03	0.11	43	3	0.25	5.0	95.0
C-560397	Unak L-28	3258.82	Husky	0.52	436	0.06	0.38	0.01	0.14	73	2	0.24	7.7	92.3
C-560398	Unark L-24	2735.63	Kugmallit	0.90	432	0.02	0.49	5.25	0.05	54	583	0.38	22.2	77.8
C-560399		3766.30	Taglu	0.97	426	0.05	0.28	0.32	0.15	29	33	0.13	4.1	95.9

RESULTS AND DISCUSSIONS

Table 2 lists the Rock-Eval/TOC results obtained the core samples in this study. The Rock-Eval hydrocarbon FID-pyrograms showing the S1 and S2 peak curves are presented in Appendix A for all the core samples in the order of their sample ID number.

All the samples in this study have a TOC greater than 0.5% except one sample (C-560284) from Blow River YT E-47 well. An examination of the FID-pyrograms indicates that, while most of the samples in this study have normal-shaped S1 and S2 peaks, significant front shoulders do occur on the S2 peaks of several samples that have relatively high S1 peaks. This is believed to be caused by residual heavy hydrocarbons that cannot be released during the thermal desorption stage for the S1 peaks, and is mostly related to oil impregnation and accumulation. These samples have been highlighted light brown in Table 2. Accordingly their maturity parameter Tmax values seem to be slightly lowered due to the release of the heavy hydrocarbons prior to kerogen decomposition. In addition, some samples have very low and flattened S2 peaks due to their high maturity, and this also resulted in abnormally reduced Tmax values by comparison with samples from similar depths of the same wells. This is especially true for samples C-560281 to C-560284 from Blow River YT E-47 well, C560362 to C-560366 from Roland Bay YT L-14 well and C-560371 to C-560372 from Spring River YT N-58 well where the cored sections are likely at over-mature stage of oil generation evident from the fact that shallower samples have high Tmax values. These samples have been highlighted light green in Table 2.

Examination of the shape of S2 peaks and the Tmax values also reveal some other interesting findings. For example, the Tertiary coal sample C-560376 from Taglu G-33 well has a relatively narrow S2 peak and a Tmax of 357°C. This likely indicates that productive organic carbon in the Kugmallit coal is mainly composed of resinite that can convert to hydrocarbons at a lower temperature compared with other organic macerals (Snowdon 1980; Snowdon and Powell, 1982). In contrast, the productive carbon in the mudstone sample C-560375 collected below the coal sample is likely composed of resinite and a similar amount of

another organic maceral that generates hydrocarbon at a higher temperature, resulting in a much wider S2 peak and a higher Tmax value. These two samples have been highlighted light blue in Table 2. The presence of a different or special type of organic matter may also occur to sample C-560300 from the Husky Formation of Kimik D-29 well and sample C-560275 from the Arctic Red Formation of Atigi G-04 well (highlighted light purple in Table 2). They have lowered Tmax values compared to other samples from the same well, but display a narrow and symmetric S2 peak.

Tertiary Source Rock Potential

Shown in Figure 2 are the histograms of TOC, S1 and S2 parameters for the Tertiary core samples. Other than samples collected from coal seams and adjacent to coal measures, most of the Tertiary core samples have a TOC content in the range of 0.90~5.0%, a S1 value of 0.02~1.0, and a S2 value in the range of 0.20~4.0 (Table 2 and Figure 2). Although the potential source rocks in the Tertiary section of the Beaufort-Mackenzie Basin contain fair to good amount of organic matter (e.g. kerogen), they seem to have only fair hydrocarbon potential due to the low quality of organic matter related to their depositional environment. The Tertiary shale and mudstone as well as coal samples are all at immature to marginally mature stage with a Tmax in the range of 400~436°C. Their hydrogen index (HI) values are mostly below 150 (Table 2 and Figure 3), indicating that the organic matter in the Tertiary source rock system is predominantly gas-prone Type III which is also evident from the plot of HI vs OI (Figure 4). In addition, Rock-Eval data suggest that the part of organic matter that can be converted into hydrocarbons in the Tertiary source rocks upon further burial is in the range of 4-30% (average 17%) of the total amount of organic matter, with the remaining 70 to 96% (average 83%) being inert carbon. Considering their low maturity, this also reveals the poor hydrocarbon potential of the Tertiary source rocks in the Beaufort-Mackenzie Basin. This is likely due to the dominance of higher plant organic input during the deposition of the Tertiary sequences in a marine deltaic environment (Dixon, 1995; Osadetz et al., 2005).

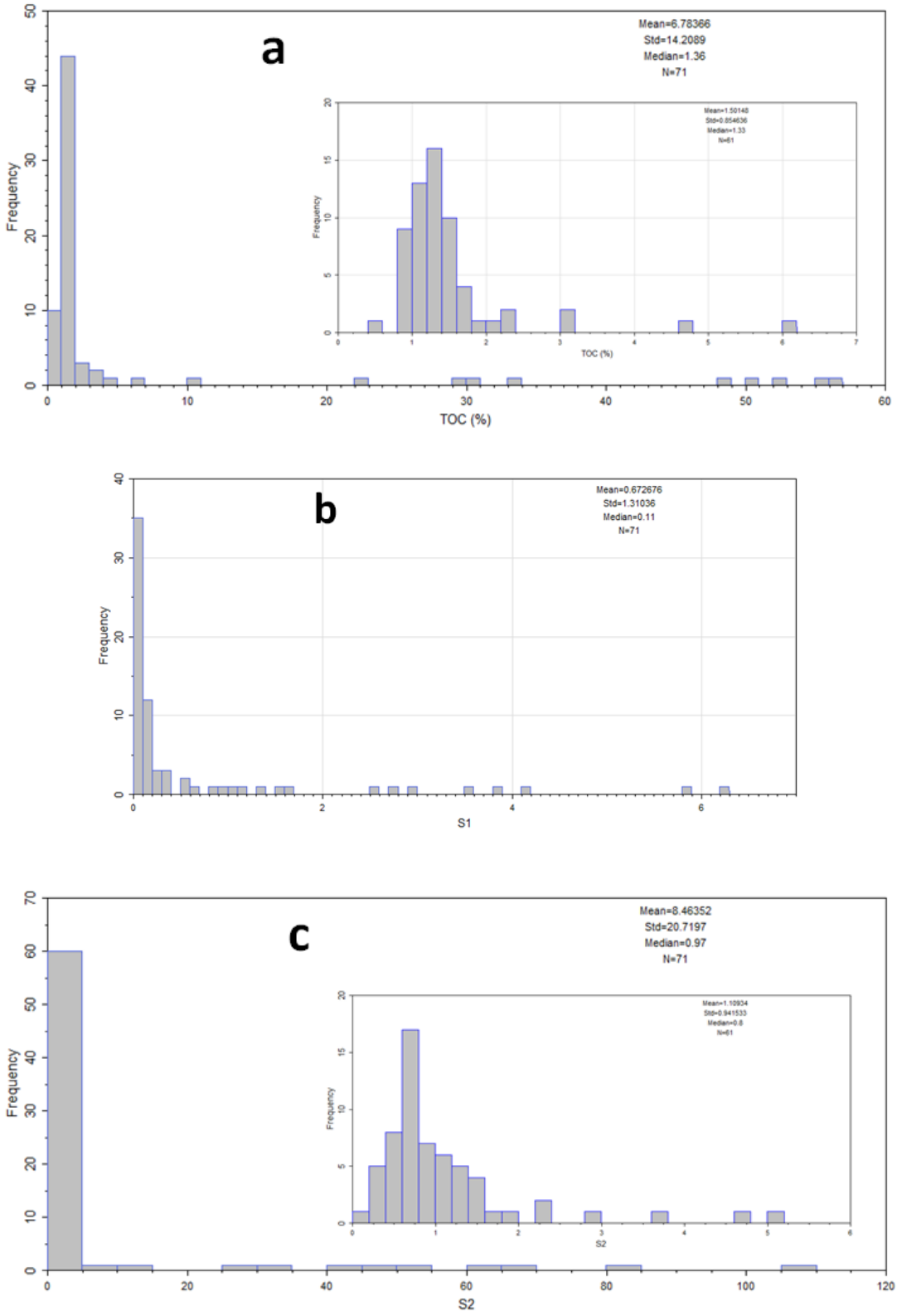

Figure 2. Organic richness as shown by (a) TOC content, (b) S1; and (c) S2 values from Rock-Eval analysis of Tertiary potential source rock samples from Beaufort-Mackenzie Basin. Insets in (a) and (c) are the distributions of the 61 samples with lower values respectively.

It is noteworthy that the Tertiary shale and mudstone core samples show a wide variation in their oxygen index OI values, ranging from 15 to 947 mg CO_2/g TOC (Table 2; Figure 5). In contrast, the OI value is below 150 in the organic-rich Tertiary coal and coal-related mudstone samples. Furthermore, OI values of the Cretaceous and Jurassic core samples in this study, some of them even from the same wells as those Tertiary samples with high OI values, are also all less than 150. Therefore, it is unlikely that the extremely high OI values observed in some of the Tertiary core samples are due to core handling and storage. As the TOC contents of the Tertiary core samples are greater than 0.5% and their carbonate mineral contents appear to be minor based on the MINC% (Table 2), these high OI values seem to reflect the true presence of oxygen-containing structures in the organic matter of the Tertiary mudstone samples. In fact, the occurrence of unusually high OI value has also been observed in other Tertiary core samples previously analyzed from the Beaufort-Mackenzie Basin (GSC internal data; Issler 2015, personal communication). Furthermore, organic petrographic observation indicated that the Tertiary sequences contain significant amount of re-worked and re-deposited organic material (Goodarzi, 1995; Issler et al., 2012). The original organic matter in the re-worked sediment could have been potentially oxidized to a greater degree due to outcrop erosion of the older aged rocks and during transportation to and within the deltaic depositional environment, resulting in an increased oxygen content in the Tertiary source rock organic matter. Compared with the shale deposition under normal marine conditions, the less reducing deltaic environment during the deposition of Tertiary sequences in the Beaufort-Mackenzie Basin might have led to early diagenetic oxidation, another cause for the abnormally high OI values (Peters, 1986).

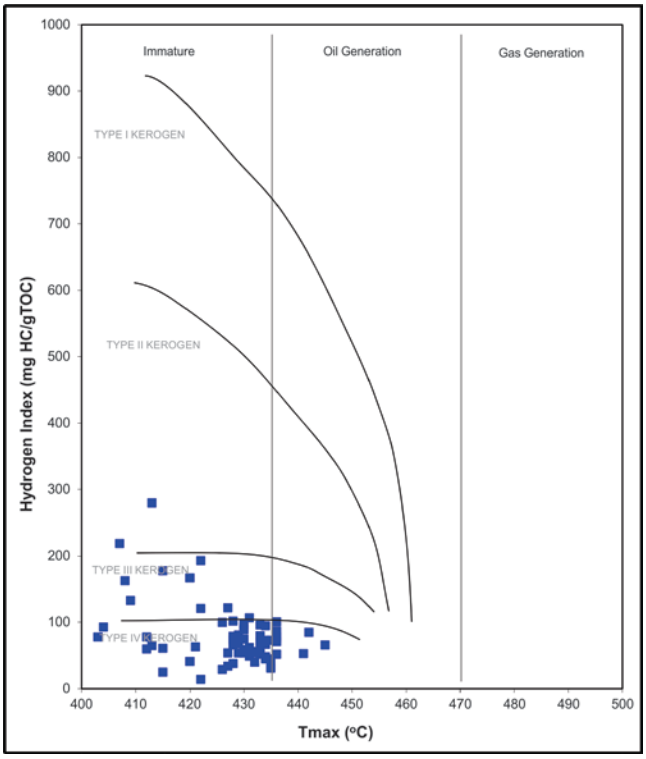

Figure 3. Plot of Rock-Eval hydrogen index (HI) vs Tmax for the Tertiary core samples from Beaufort-Mackenzie Basin.

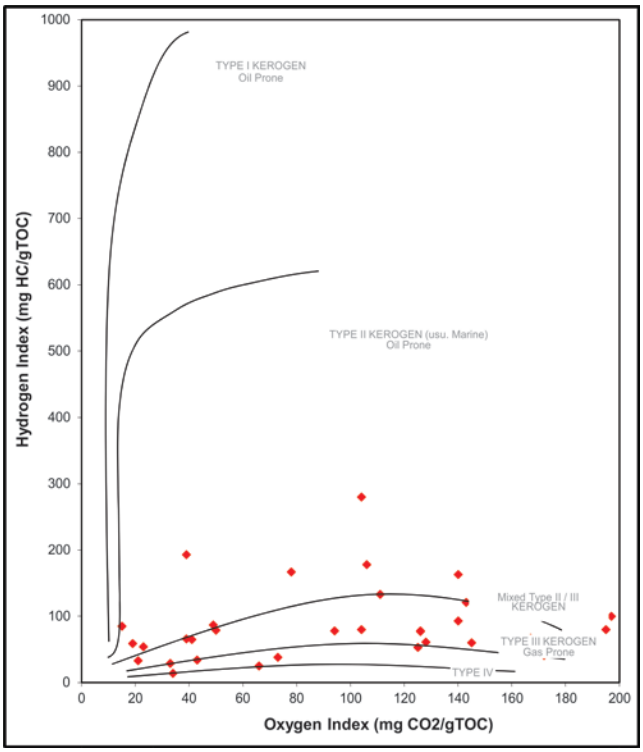

Figure 4. Plot of Rock-Eval hydrogen index (HI) vs oxygen index (OI) for the Tertiary core samples from Beaufort-Mackenzie Basin.

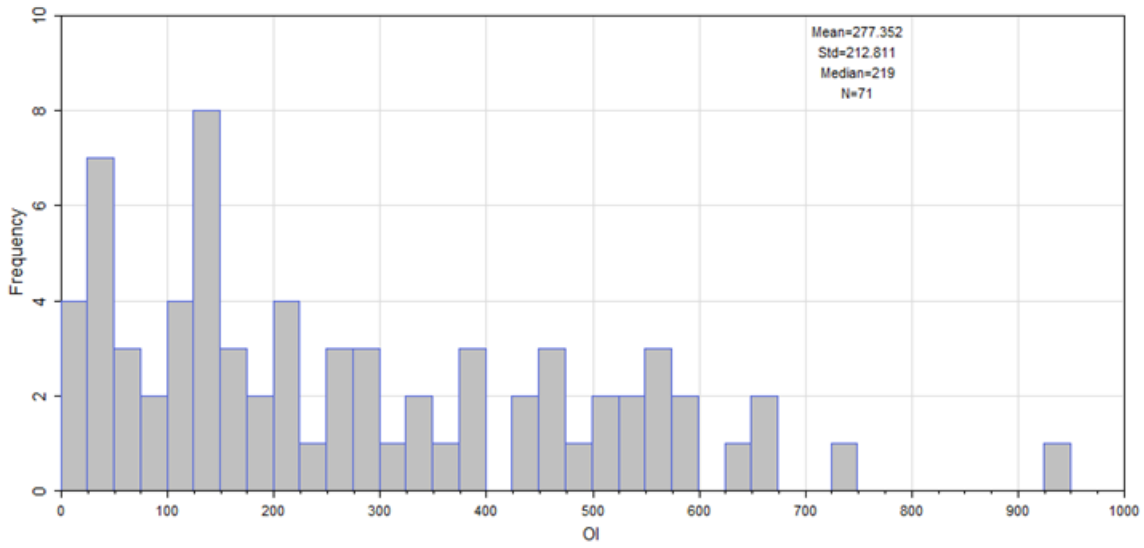

Figure 5. Histogram showing the distribution of oxygen index OI for the Tertiary potential source rock core samples from Beaufort-Mackenzie Basin.

Whether these high OI values for the Tertiary mudstone/shale samples are true reflection of the poor quality of their organic matter, indicate a special mineral composition of the sample matrices, or have been caused by other factors needs further investigation. Kerogen separation followed by elemental analysis and detailed XRD analysis of selected samples with varying OI values are recommended.

Cretaceous Source Rock Potential

The Cretaceous section was rarely intersected by drilling in the offshore Beaufort-Mackenzie Basin, and thus the Cretaceous core samples collected in this study are mostly from onshore wells (Fig. 1). With the exception of coal and coal-measure mudstone samples, the Cretaceous potential source rock samples have TOC contents in the range of 0.4 to 6.8%, S1 values mostly below 0.5 mg HC/g rock, and S2 value less than 5 mg HC/g rock (Table 2 and Fig 6). Their thermal maturity varies from immature-marginally mature, through mature to over-mature, with Tmax values in the range of 420, through 440, 460 to 470°C respectively. Cretaceous sections at Roland Bay, Blow River and Spring River are over-mature, with their Tmax being around 600°C. Organic matter in the Cretaceous source rocks appears to be

mainly Type II but with some Type III (Figs 7 and 8), showing better hydrocarbon potential than the Tertiary source rocks.

It is worth noting that the coal seam encountered at the depth of 4031 to 4034m at the Ogruknang M-31 well is in the late oil window to wet gas window (Tmax of 459°C; Table 2), and sill has significant hydrocarbon potential with a HI value around 200. This indicates initial Type II organic matter for the Cretaceous coal measure in the area.

Jurassic Source Rock Potential

Similar to the Cretaceous source rock samples, the Jurassic mudstone/shale samples have a fair to good hydrocarbon potential, with their TOC contents being in the range of 0.5~6.5% (Table 2 and Fig 9). However, the Jurassic source rocks are slightly more mature due to its deeper burial depth. The original organic matter in the Jurassic source rocks appears to be a mixture of Type II and Type III (Figs 10 and 11). Based on the Rock-Eval results obtained during current and previous studies, the Jurassic source rocks seem to have lower hydrocarbon potential than the Cretaceous ones.

Permian Source Rock Potential

Only three Permian core samples were collected in this study, with a current TOC in the 0.64-1.01% range and Tmax in the range of 444-448°C. Sample C-560279 has a front shoulder to its S2 peak, and its Tmax is likely affected. It is at least clear that the Permian source rock are all mature and have little remaining hydrocarbon potential with a hydrogen index around 80mg HC/g TOC (Table 2). The original organic matter in the Permian source rocks was likely Type II.

Future Work

Based on the Rock-Eval results, the core intervals sampled in this study are suggested to be further subjected to detailed organic geochemical analysis to define their molecular signatures for the purpose of oil-source correlation, especially the Cretaceous and Jurassic sequences. Organic petrography is also recommended on selected samples to investigate their present organic maceral composition and to infer their original organic input and type of

organic matter as well as their thermal maturity. In addition, selected core samples such as those with OI values >250 are proposed to be subjected to kerogen separation and elemental analysis to investigate whether the high oxygen indices in the Tertiary mudstone samples are indeed indicative of a high content of oxygen in their organic matter. Carbon isotope analysis of the separated kerogen will be useful for distinguishing the organic matter types in different source rock systems.

ACKNOWLEDGEMENTS

We thank Krista Boyce of GSC Calgary for sample preparation and curation, and Ross Stewart for Rock-Eval/TOC analysis. This study was funded by the Natural Resources Canada through the Earth Sciences Sector GEM program.

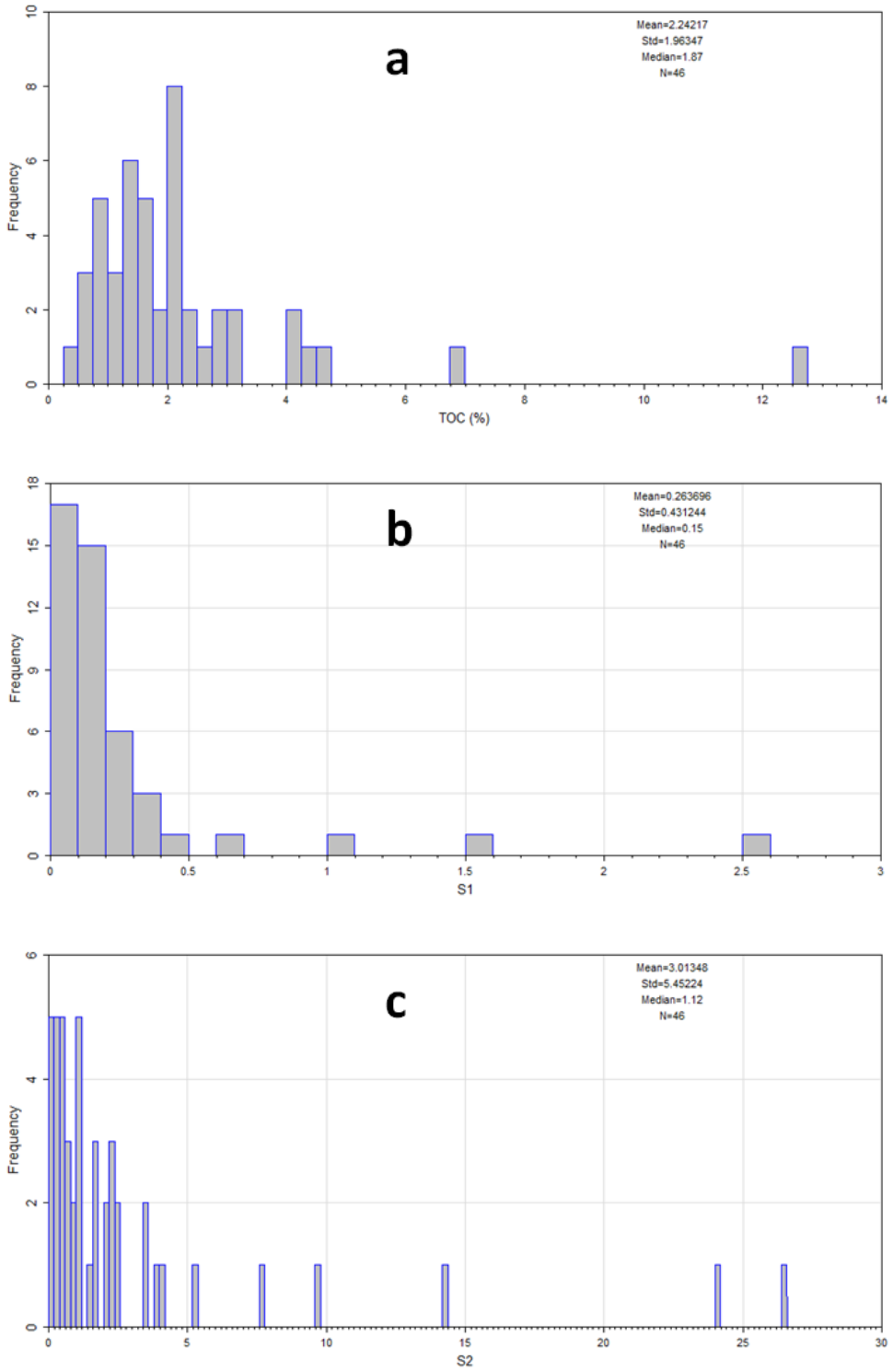

Figure 6. Organic richness as shown by (a) TOC content, (b) S1; and (c) S2 values from Rock-Eval analysis of Cretaceous potential source rock samples from Beaufort-Mackenzie Basin

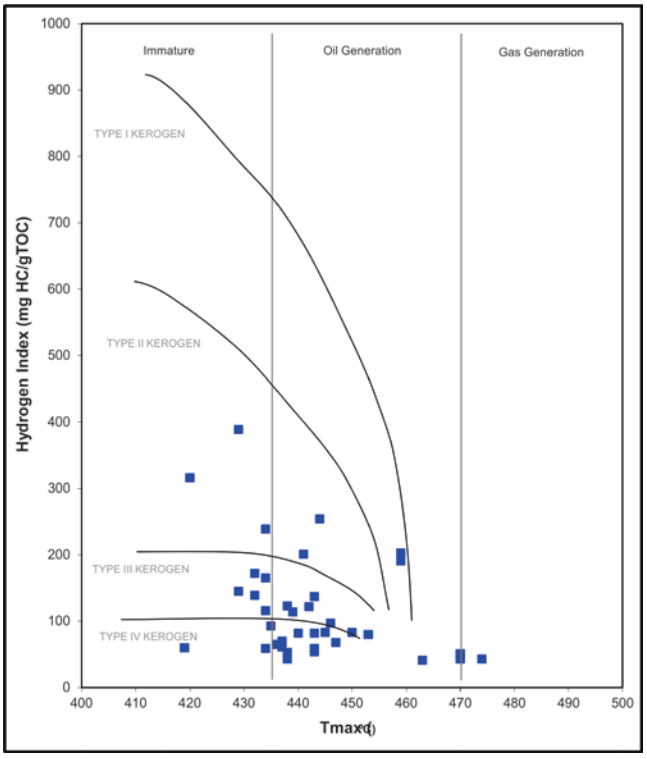

Figure 7. Plot of Rock-Eval hydrogen index (HI) vs Tmax for the Cretaceous core samples from Beaufort-Mackenzie Basin.

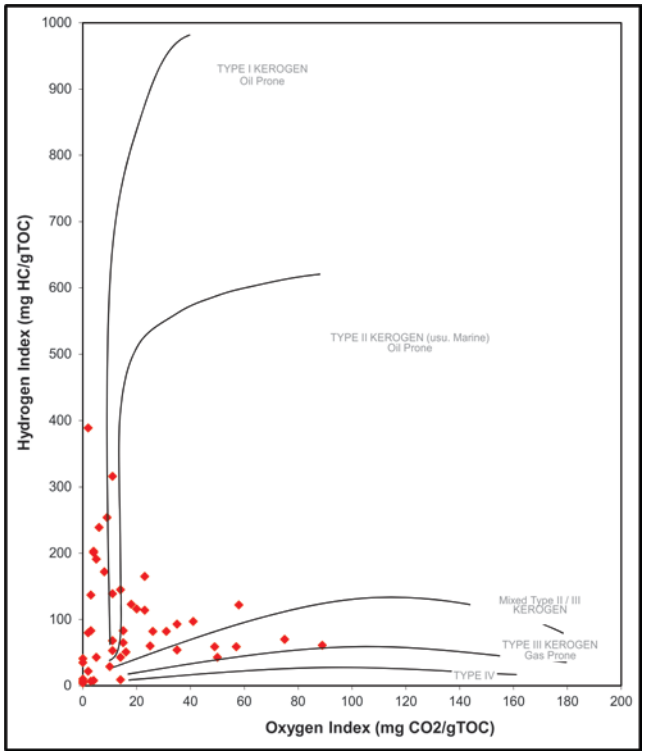

Figure 8. Plot of Rock-Eval hydrogen index (HI) vs oxygen index (OI) for the Cretaceous core samples from Beaufort-Mackenzie Basin.

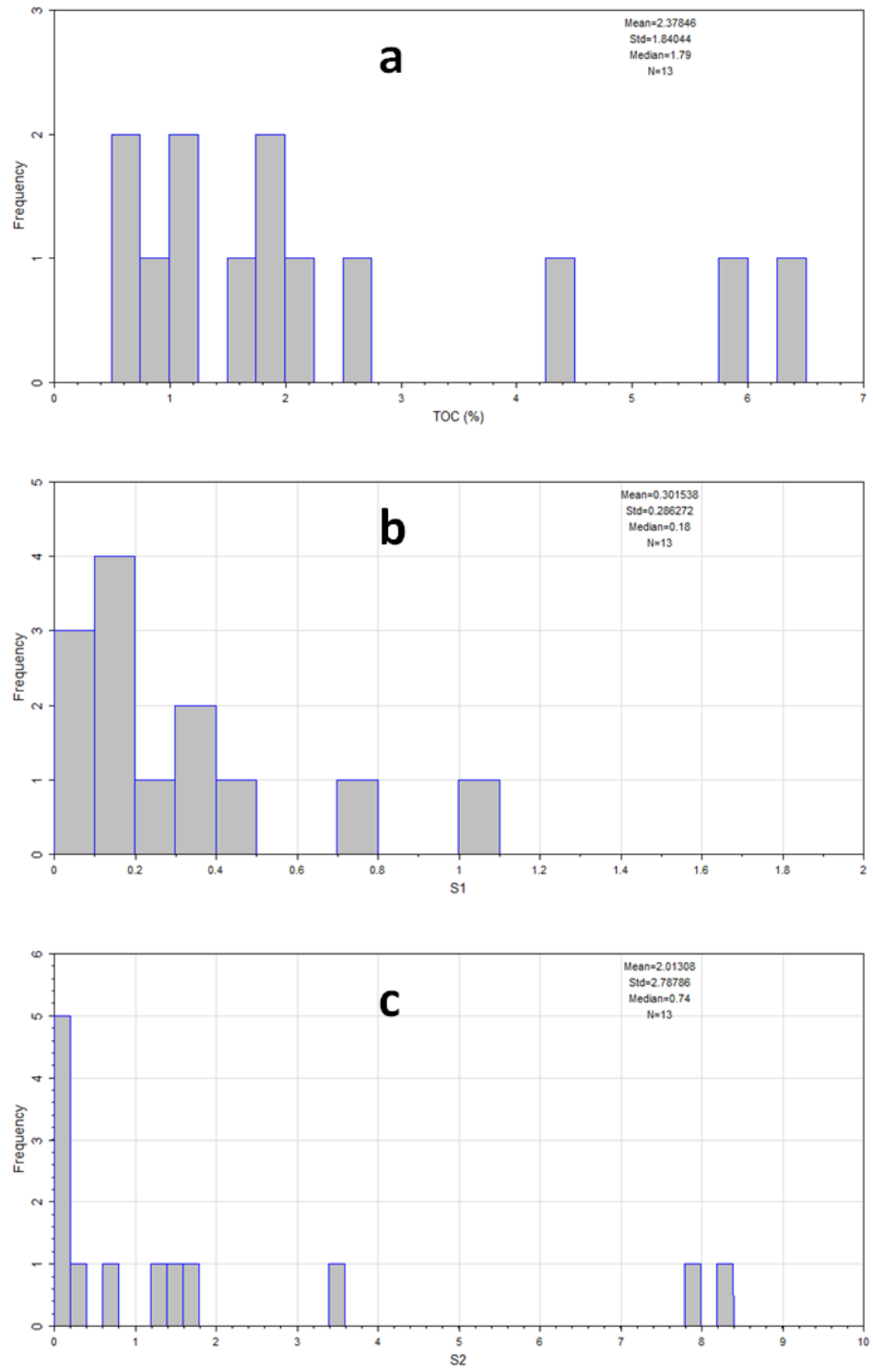

Figure 9. Organic richness as shown by (a) TOC content, (b) S1; and (c) S2 values from Rock-Eval analysis of Jurassic potential source rock samples from Beaufort-Mackenzie Basin

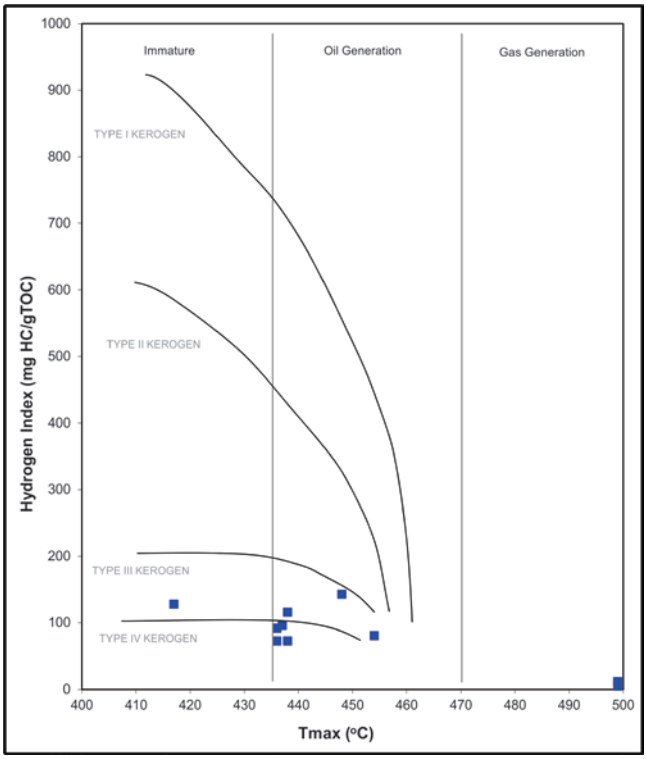

Figure 10. Plot of Rock-Eval hydrogen index (HI) vs Tmax for the Jurassic core samples from Beaufort-Mackenzie Basin.

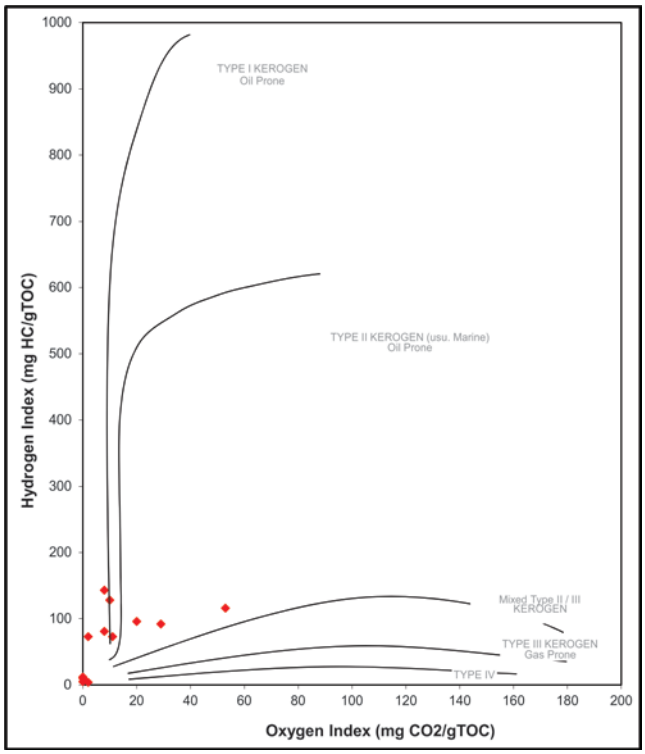

Figure 11. Plot of Rock-Eval hydrogen index (HI) vs oxygen index (OI) for the Jurassic core samples from Beaufort-Mackenzie Basin.

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Appendix A

Rock-Eval FID-pyrograms of S1 and S2 Hydrocarbon Peaks

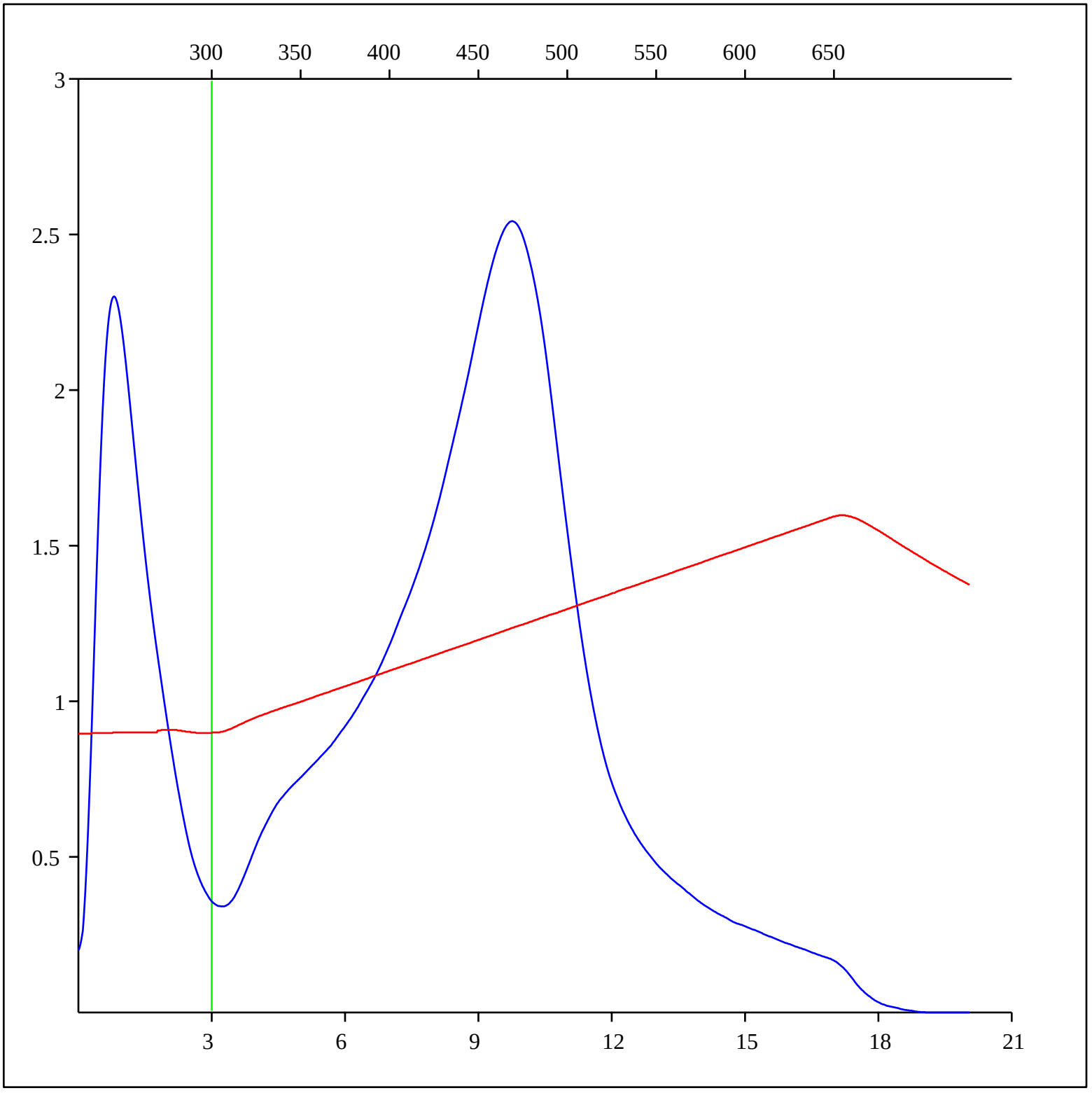
for

Core Samples from Beaufort-Mackenzie Basin

(Presented in the order of sample ID that can be found in Table 1)

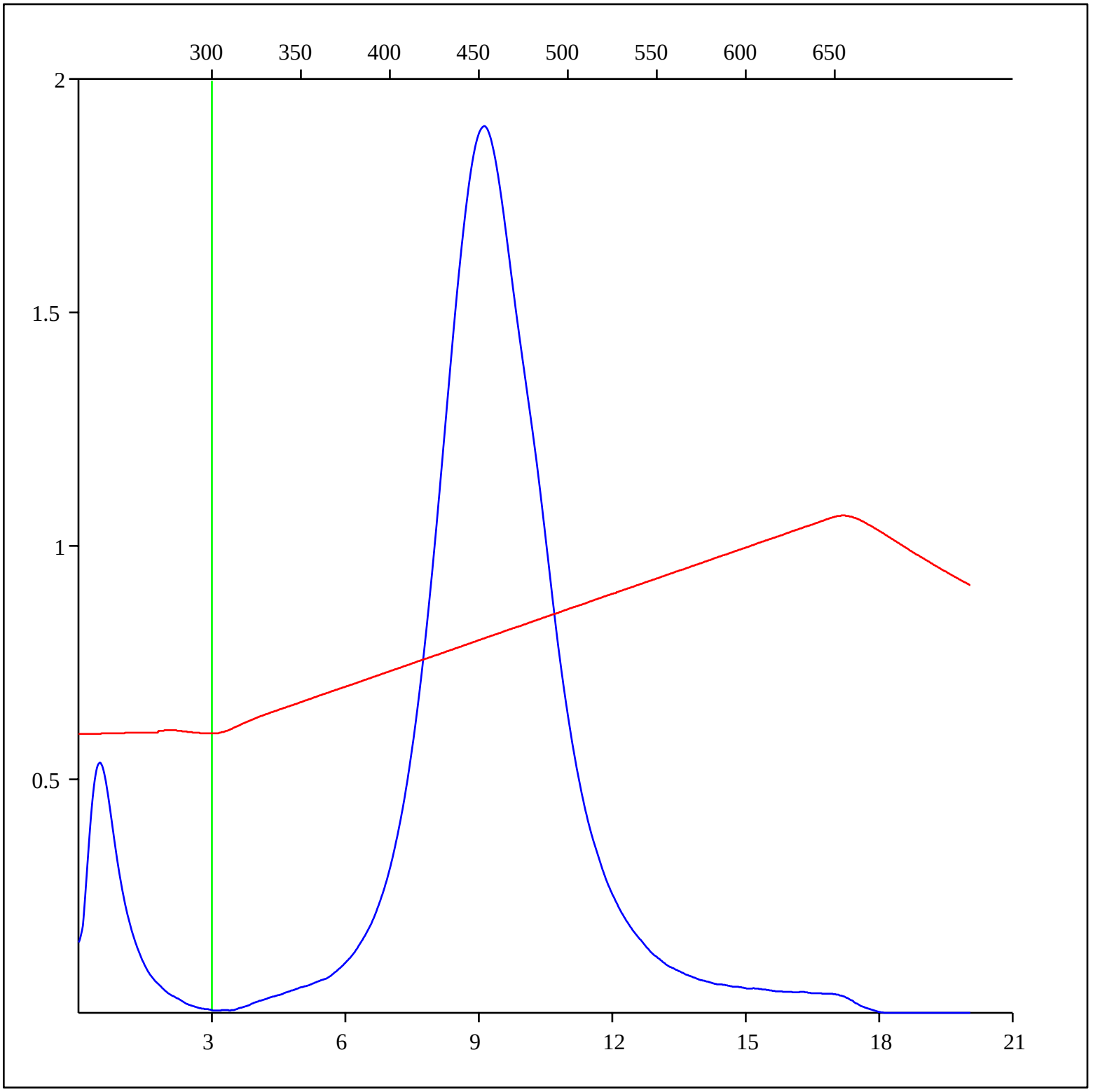
Sample: C-560266
Acquisition Date:
Location: ADLARTOK P-09
Depth: 1774.6 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



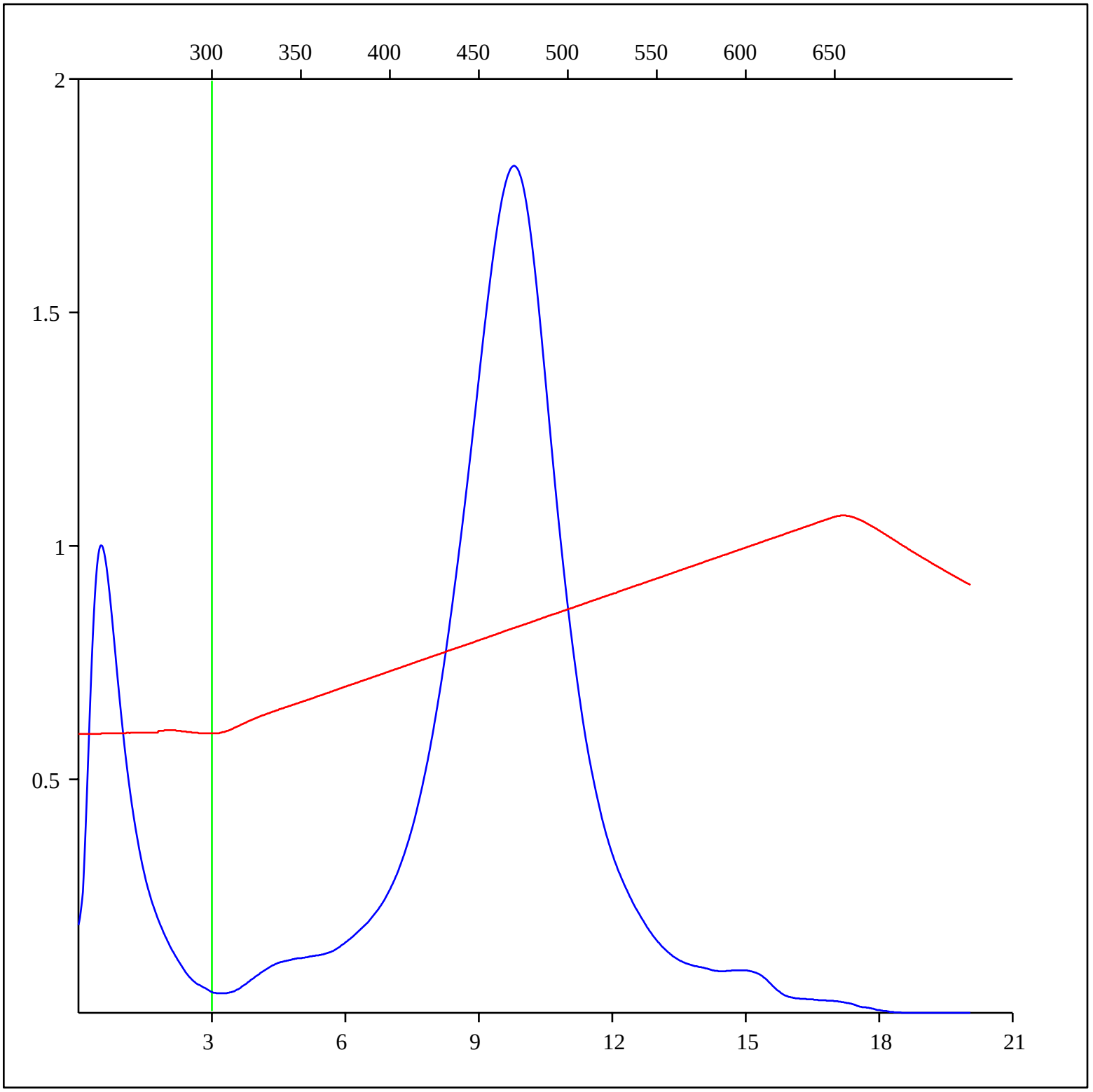
Sample: C-560267
Acquisition Date:
Location: AMERK O-09
Depth: 4374.4 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



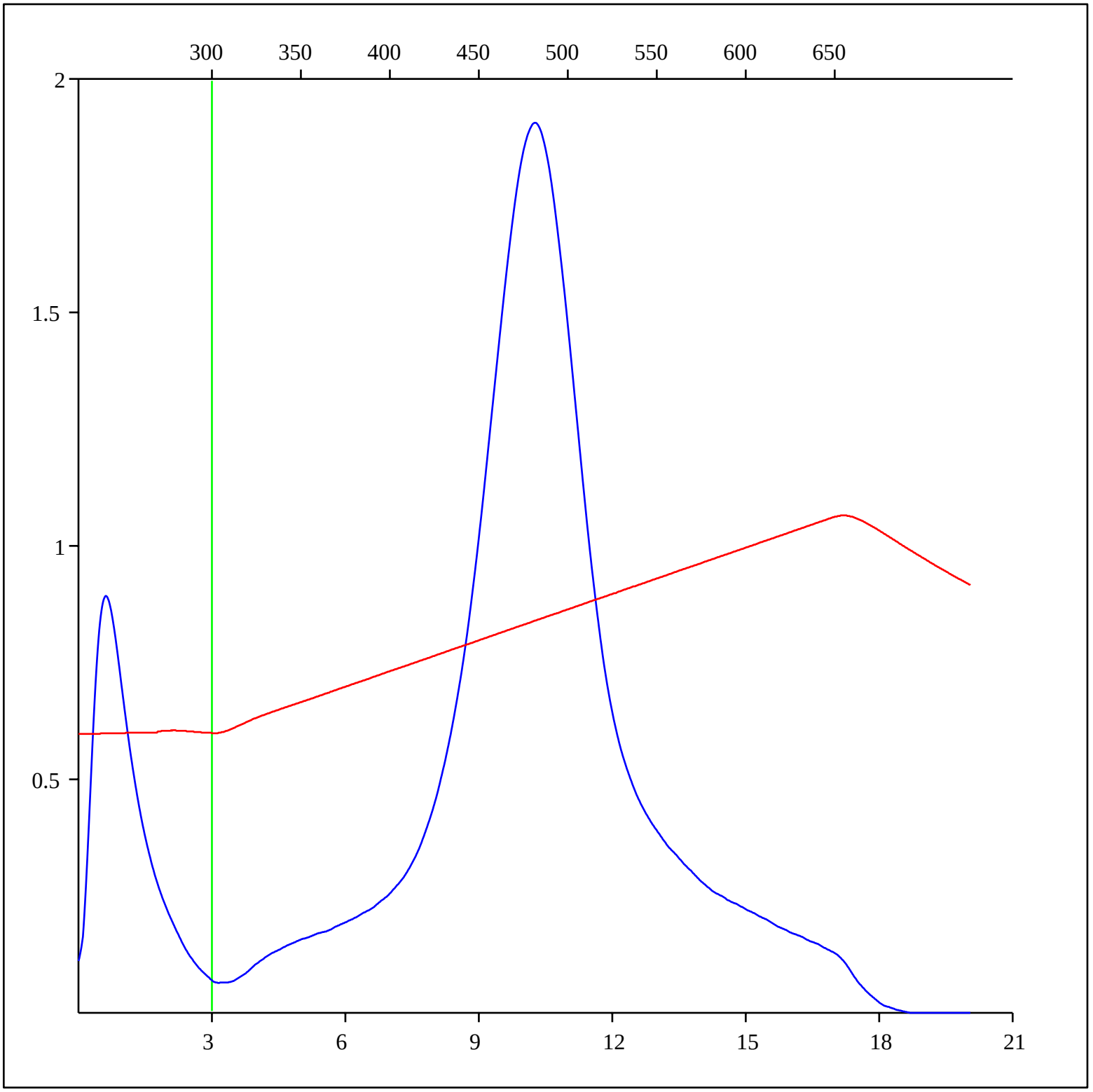
Sample: C-560268
Acquisition Date:
Location: AMERK O-09
Depth: 4606.6 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



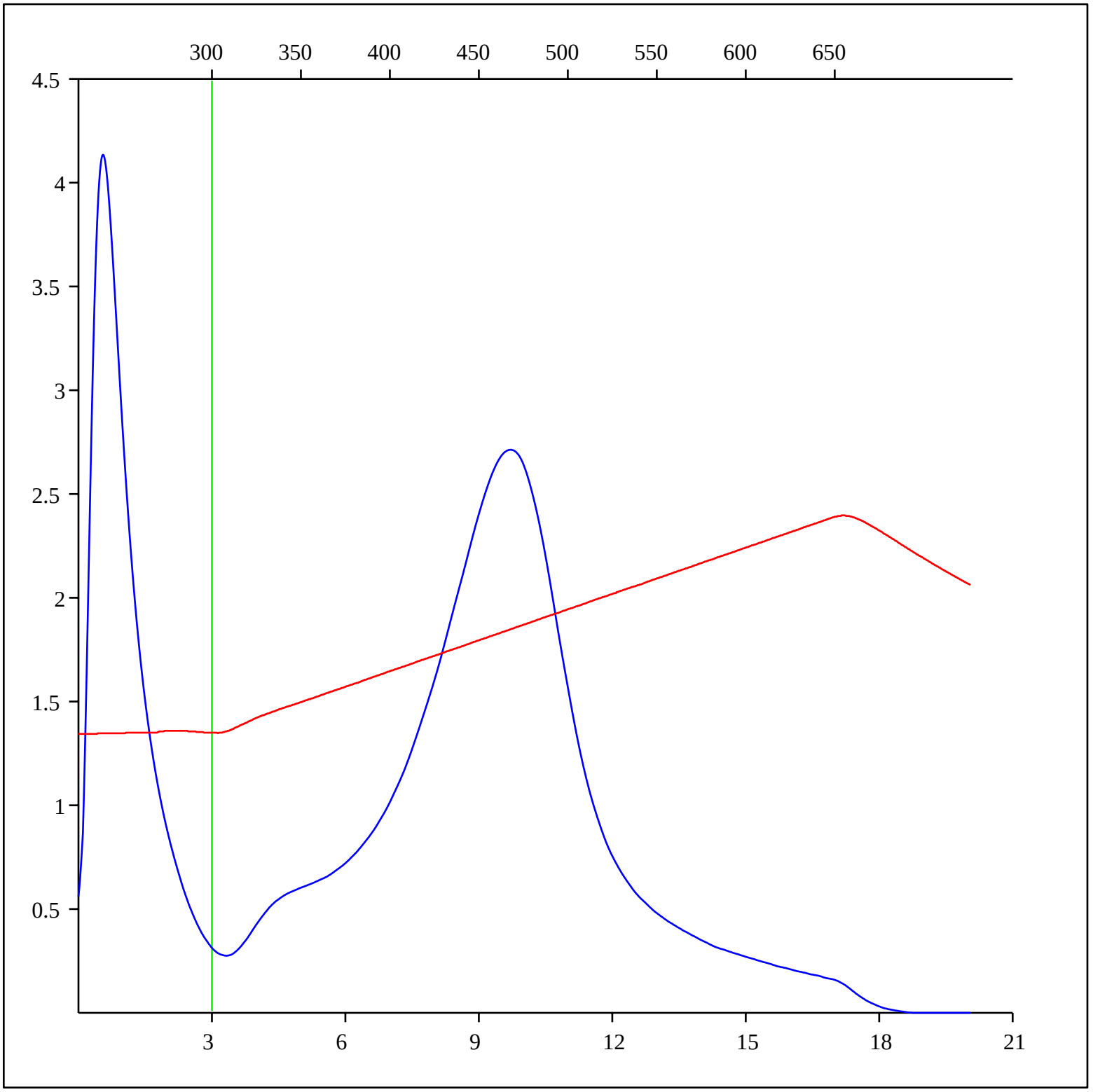
Sample: C-560269
Acquisition Date:
Location: AMERK O-09
Depth: 4862 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



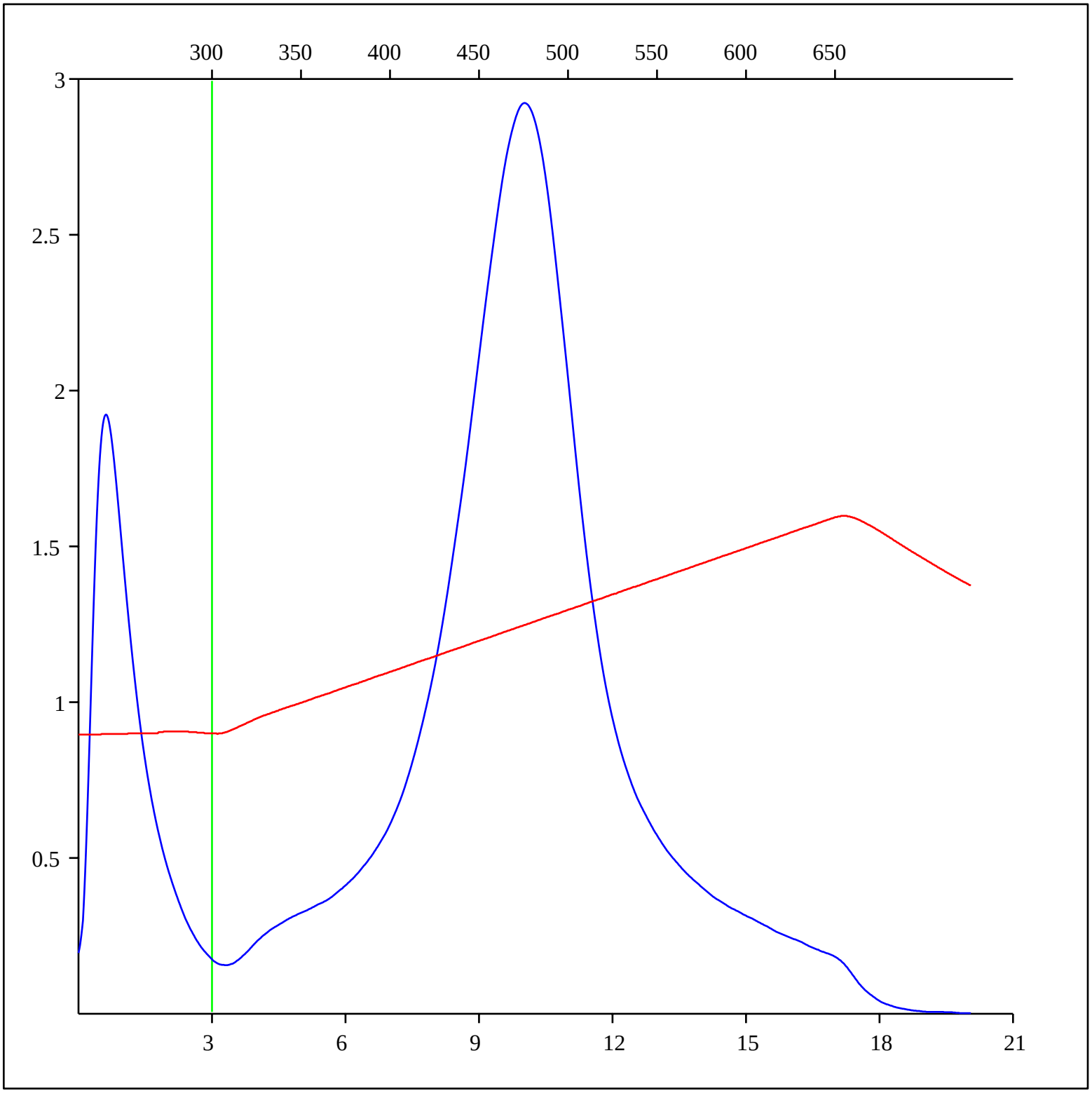
Sample: C-560270
Acquisition Date:
Location: ARLUK E-90
Depth: 3449 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



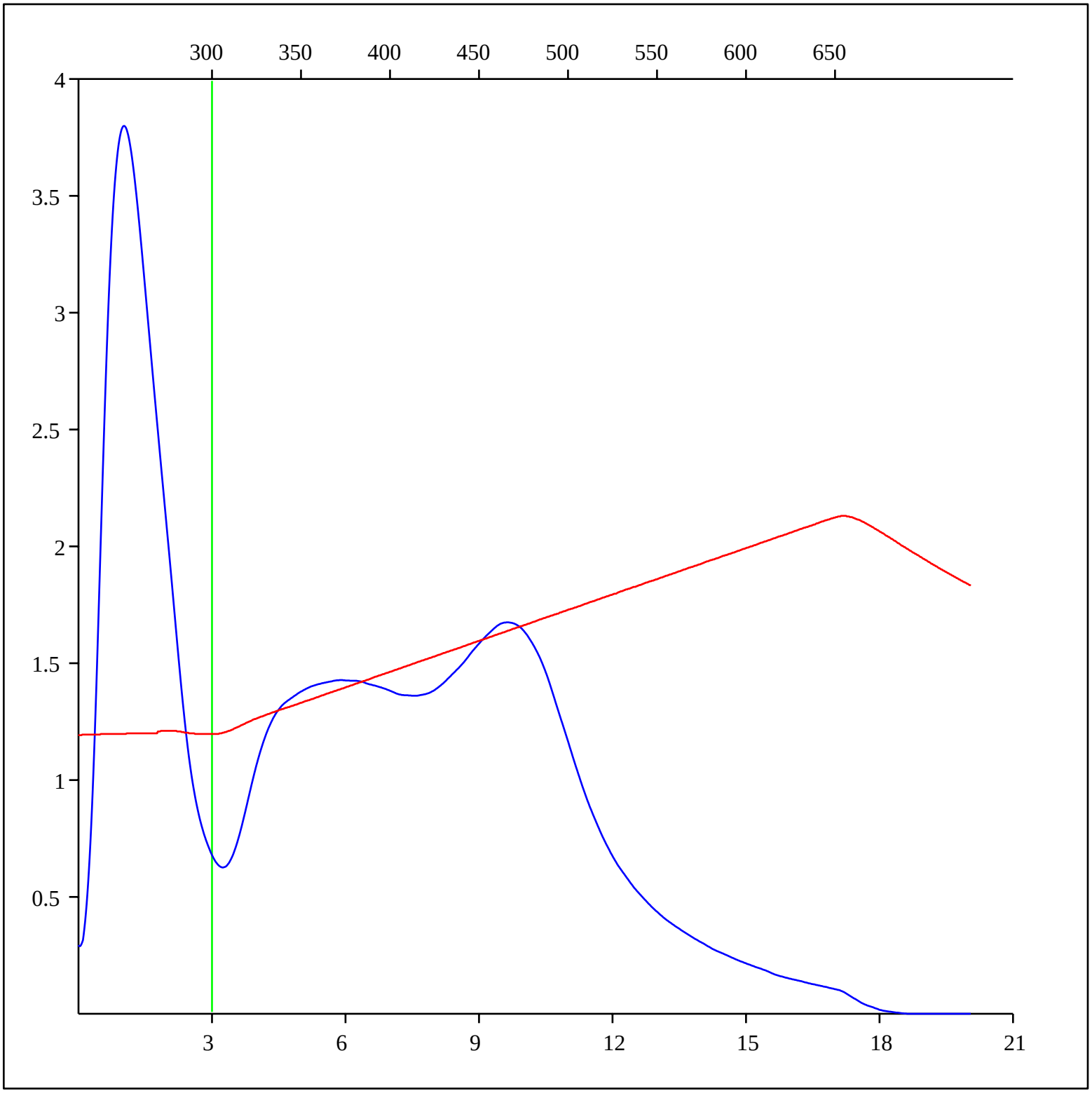
Sample: C-560271
Acquisition Date:
Location: ARLUK E-90
Depth: 3937.6 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



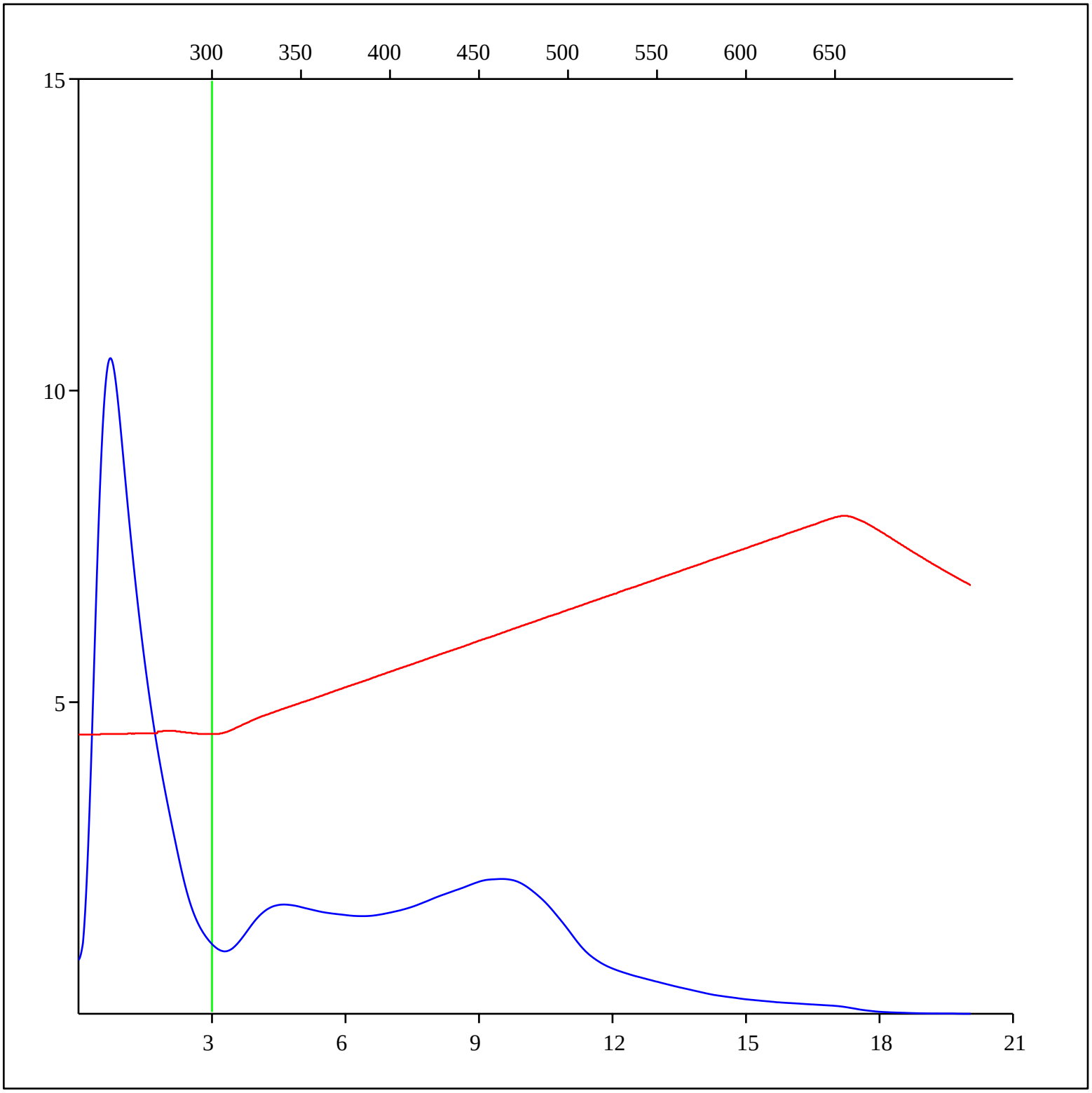
Sample: C-560272
Acquisition Date:
Location: ATERTAK E-41
Depth: 959.2 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



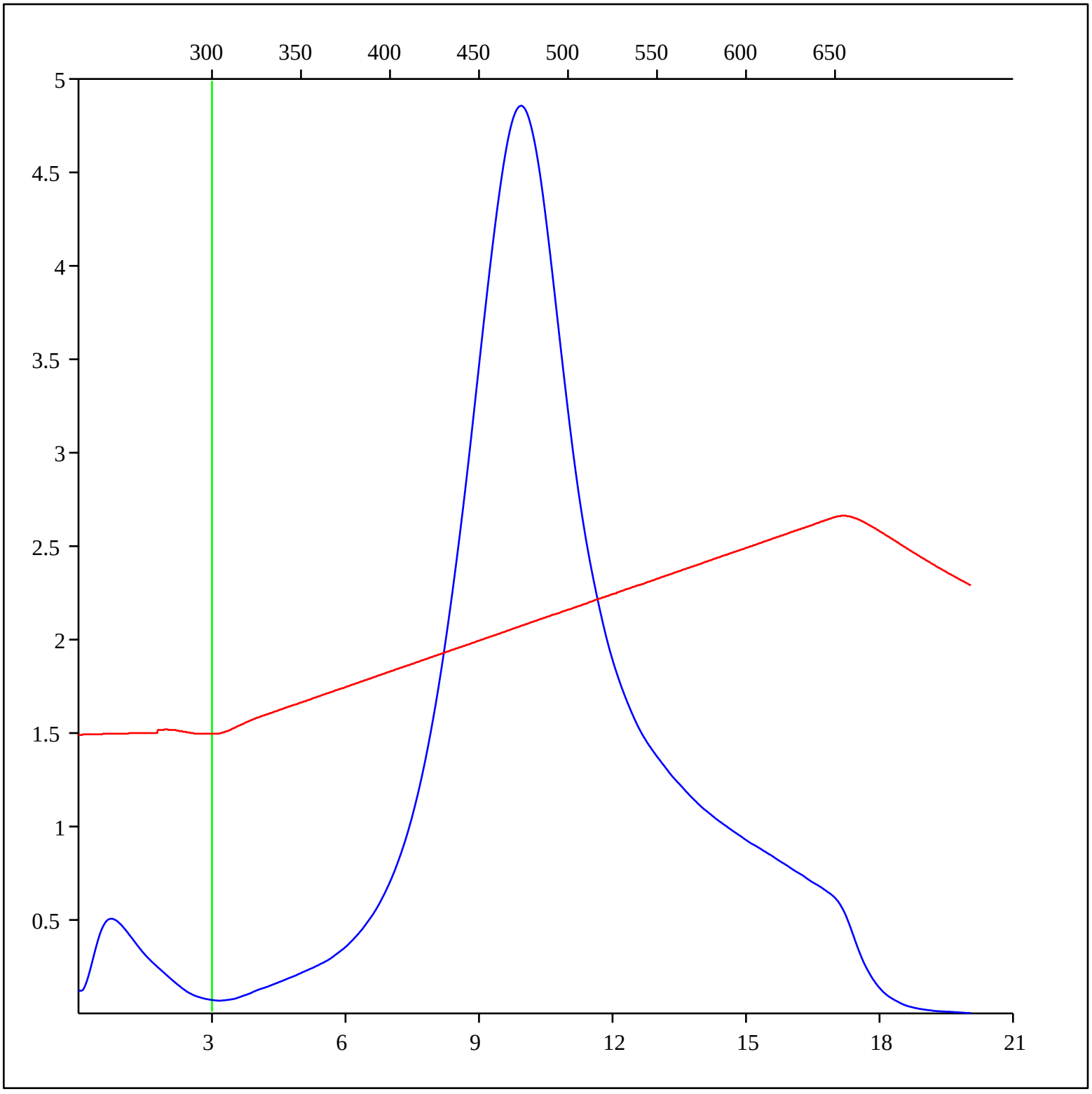
Sample: C-560273
Acquisition Date:
Location: ATERTAK E-41
Depth: 1361.4 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



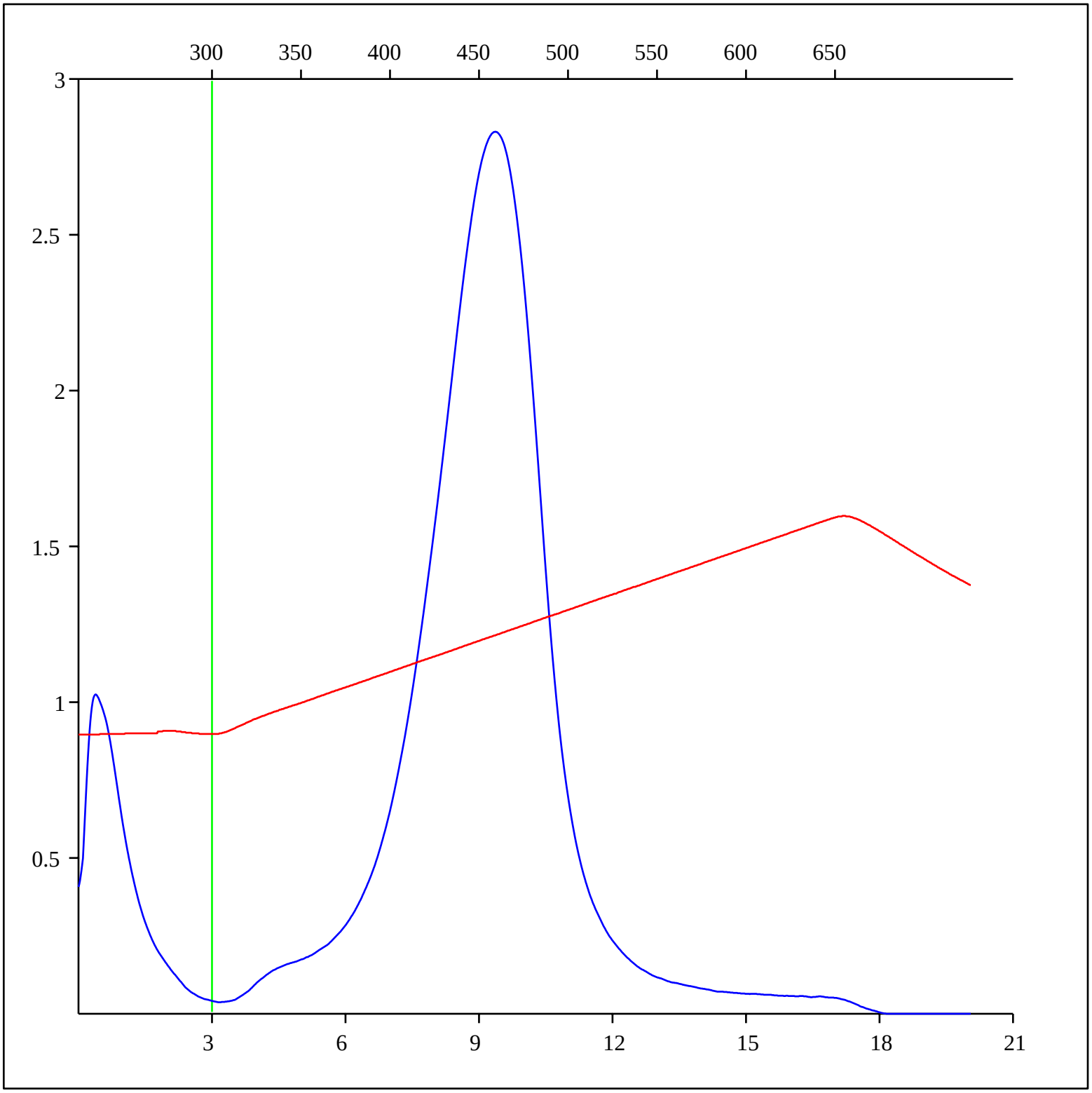
Sample: C-560274
Acquisition Date:
Location: ATERTAK K-31
Depth: 2585 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



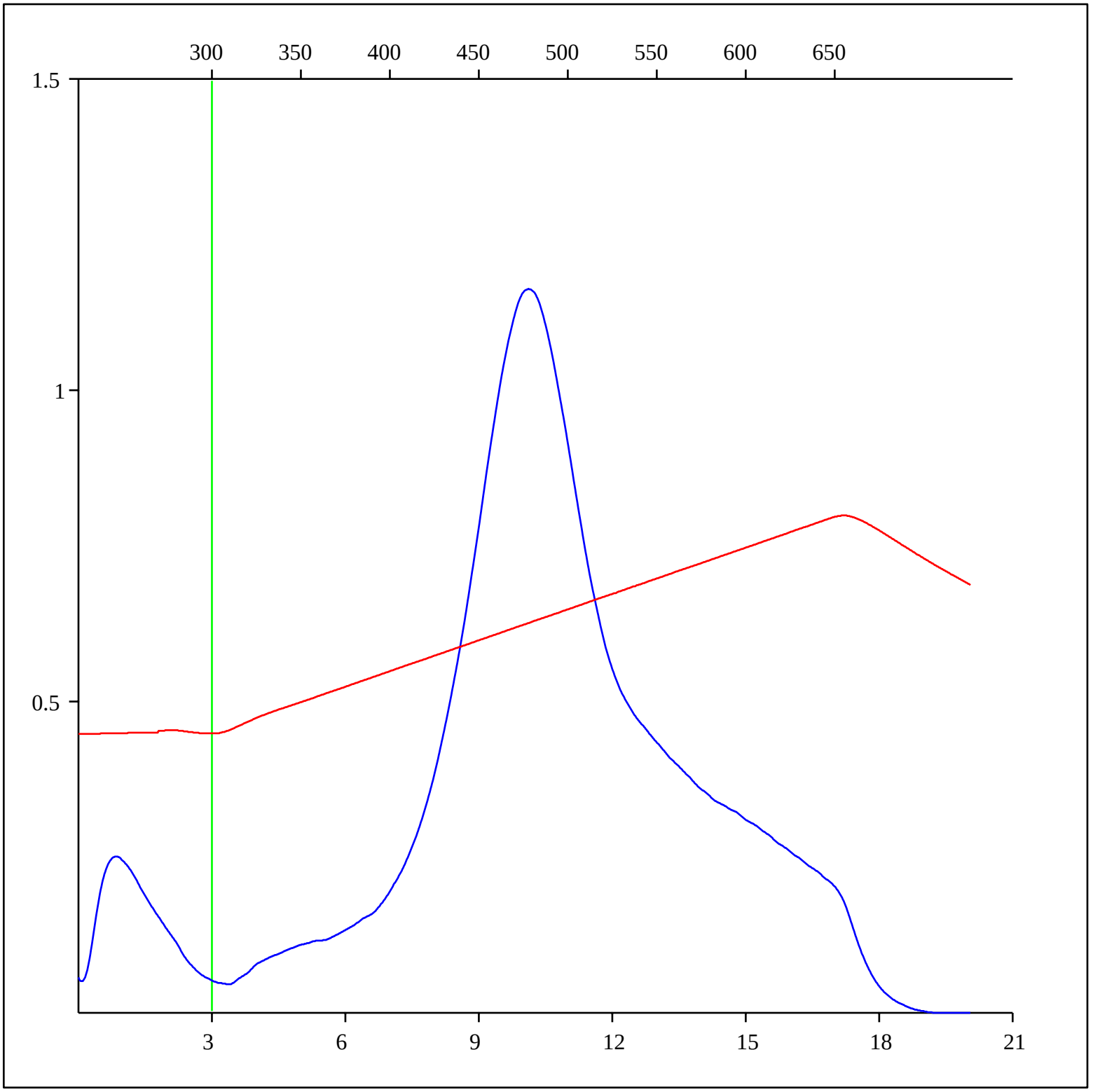
Sample: C-560275
Acquisition Date:
Location: ATIGI G-04
Depth: 1915.1 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



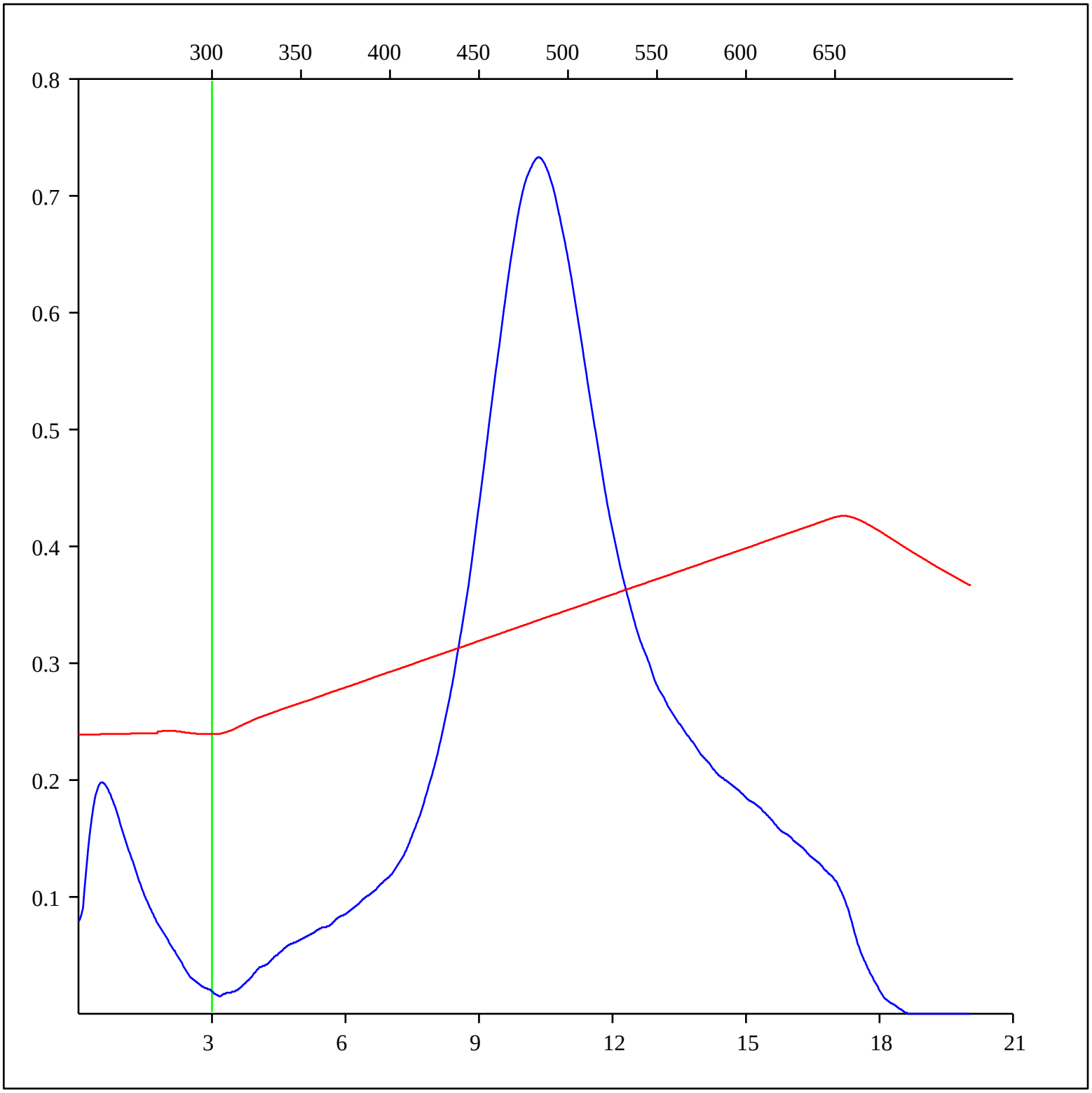
Sample: C-560276
Acquisition Date:
Location: ATIGI G-04
Depth: 2313.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



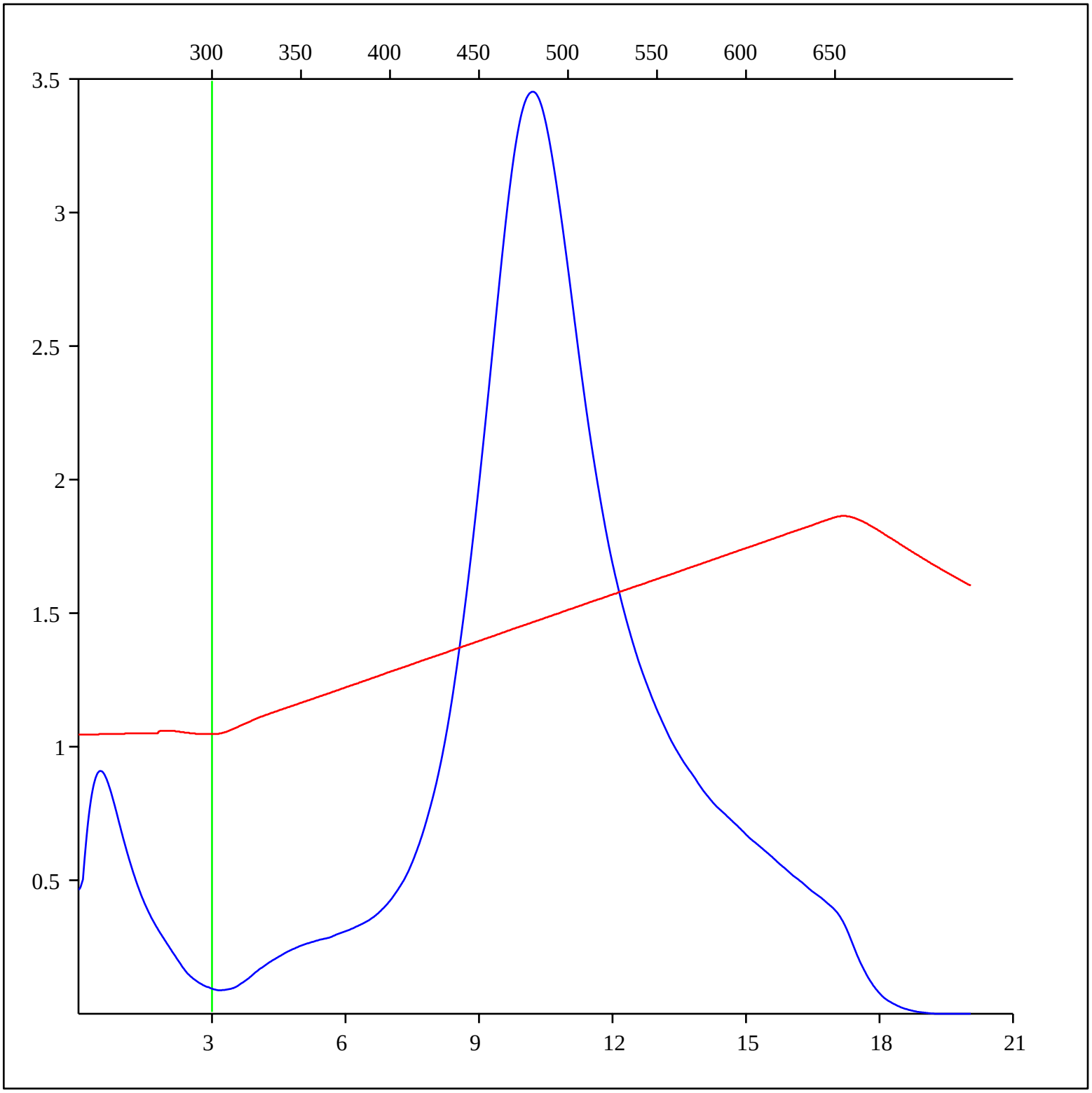
Sample: C-560277
Acquisition Date:
Location: ATIGI G-04
Depth: 2721.1 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



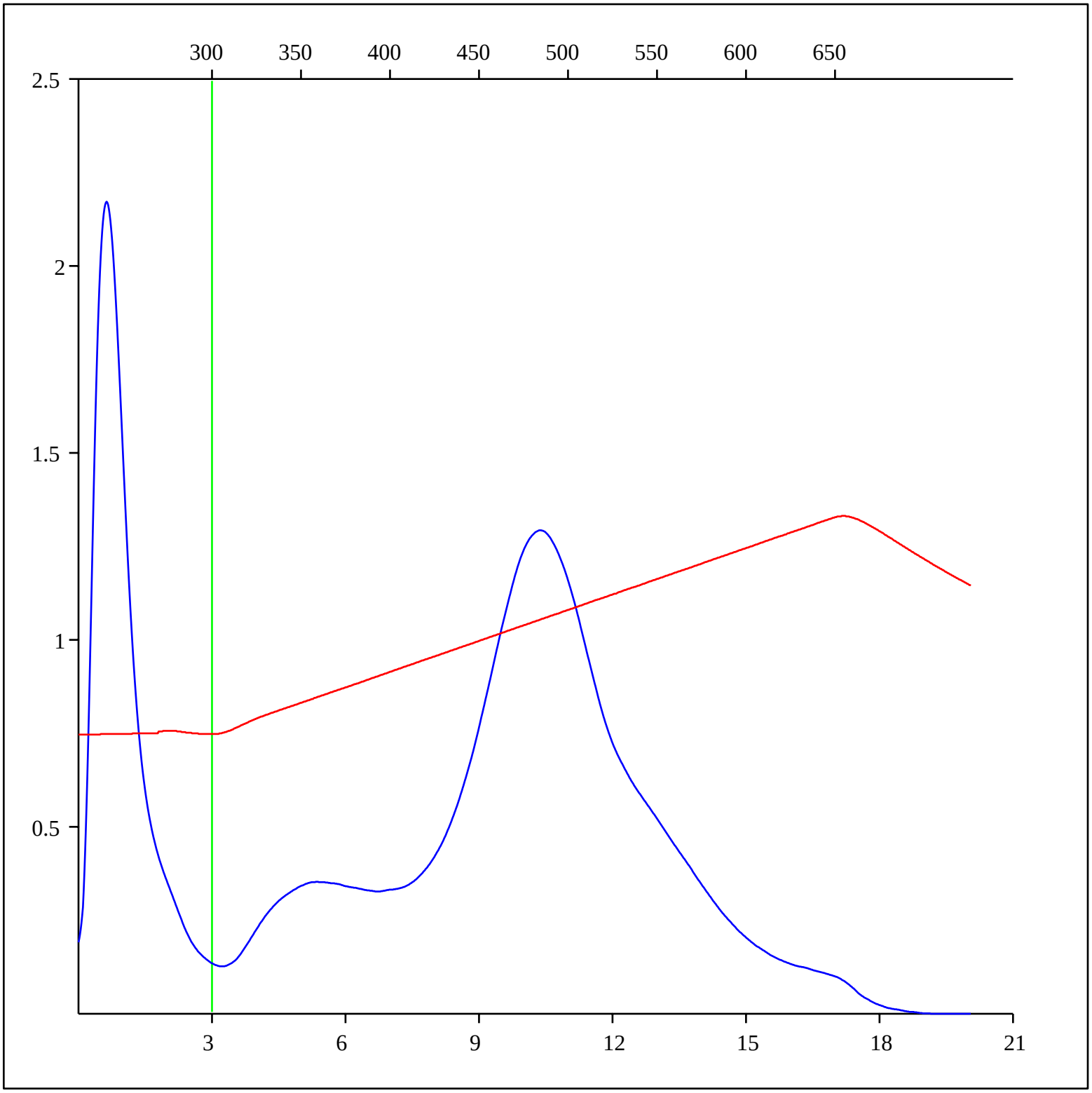
Sample: C-560278
Acquisition Date:
Location: ATIGI G-04
Depth: 2932.8 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



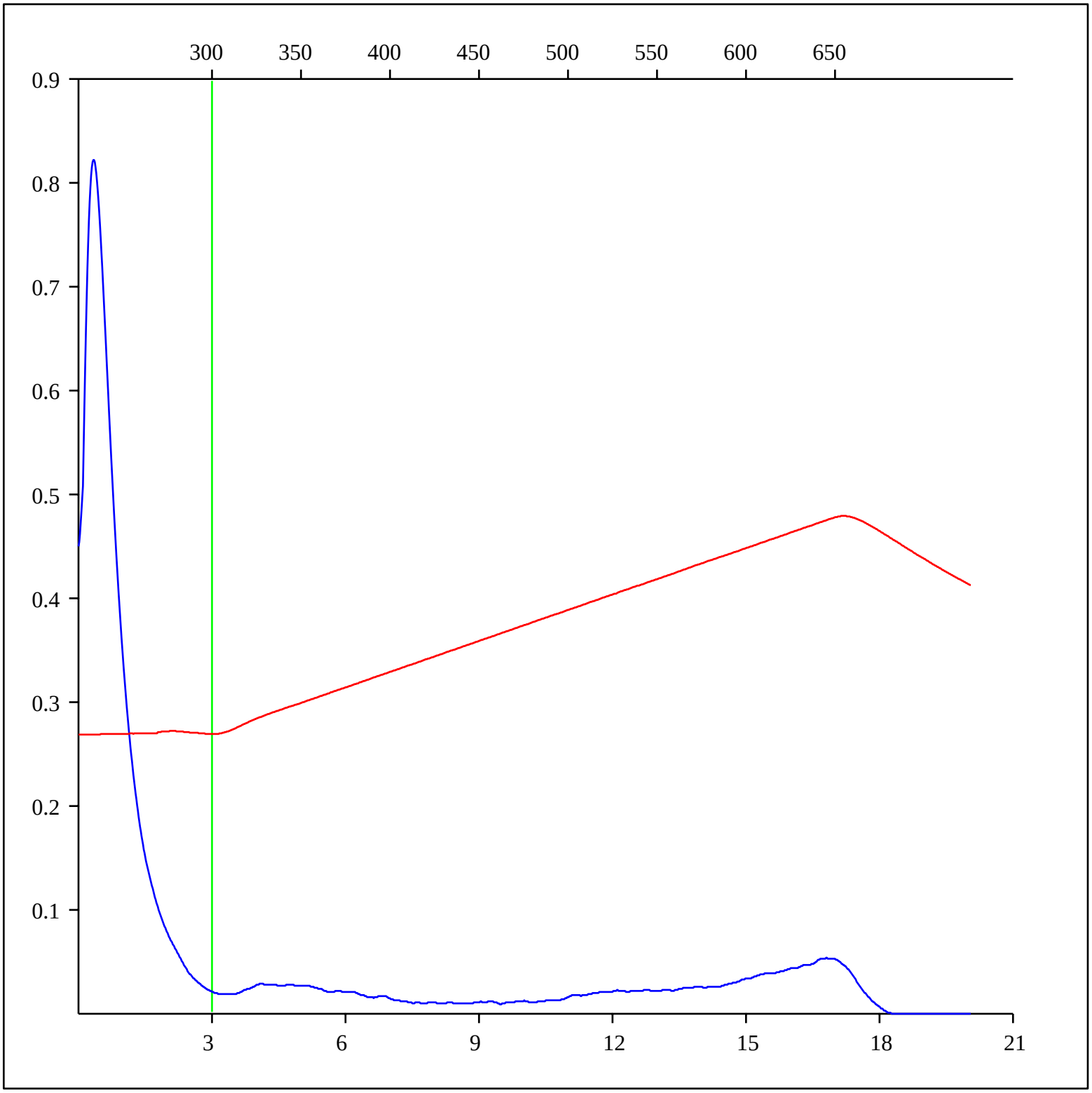
Sample: C-560279
Acquisition Date:
Location: BEAVER HOUSE CREEK H-13
Depth: 1483.4 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



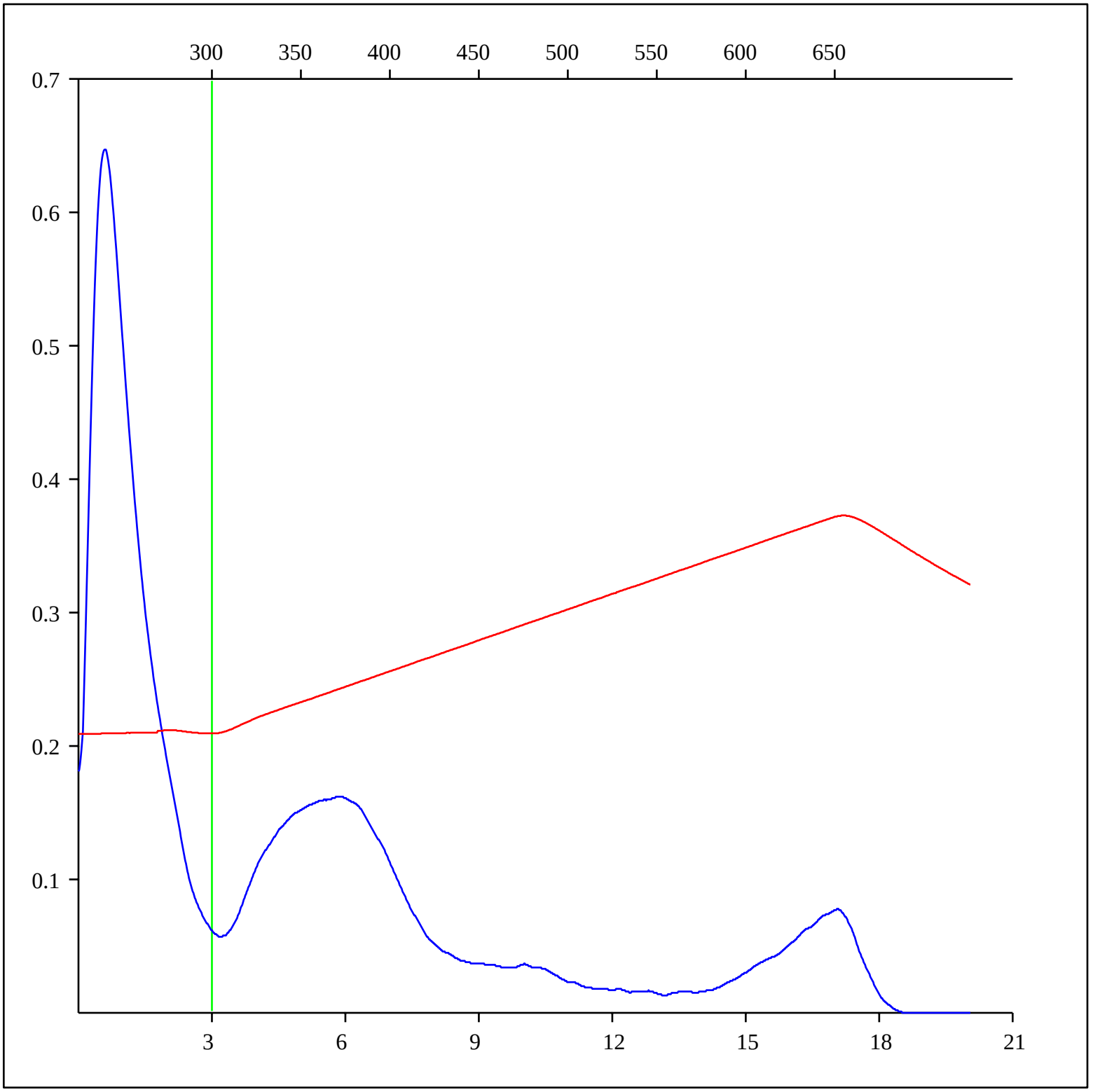
Sample: C-560280
Acquisition Date:
Location: BLOW RIVER YT E-47
Depth: 615.55 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



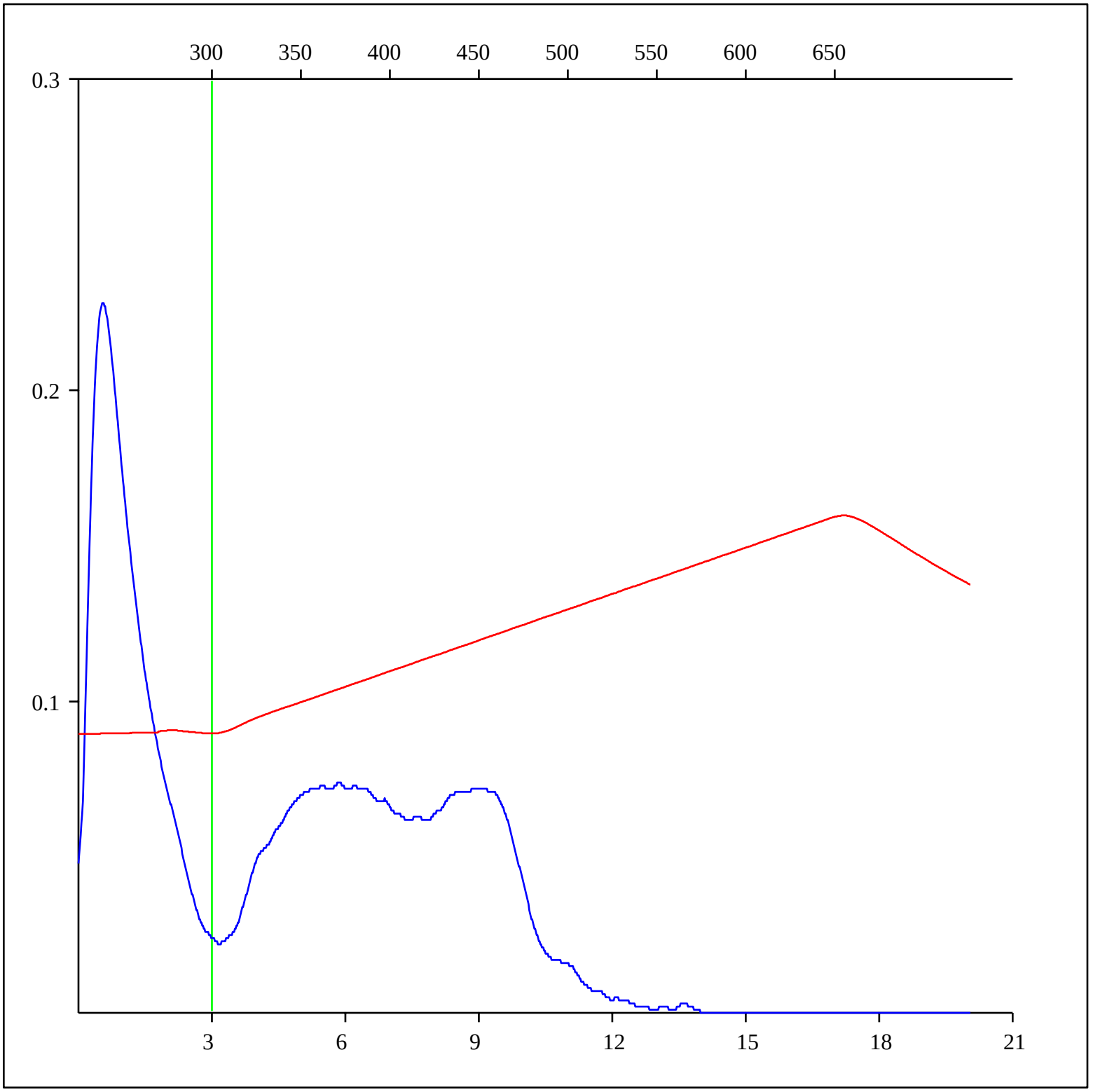
Sample: C-560281
Acquisition Date:
Location: BLOW RIVER YT E-47
Depth: 1524.1 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



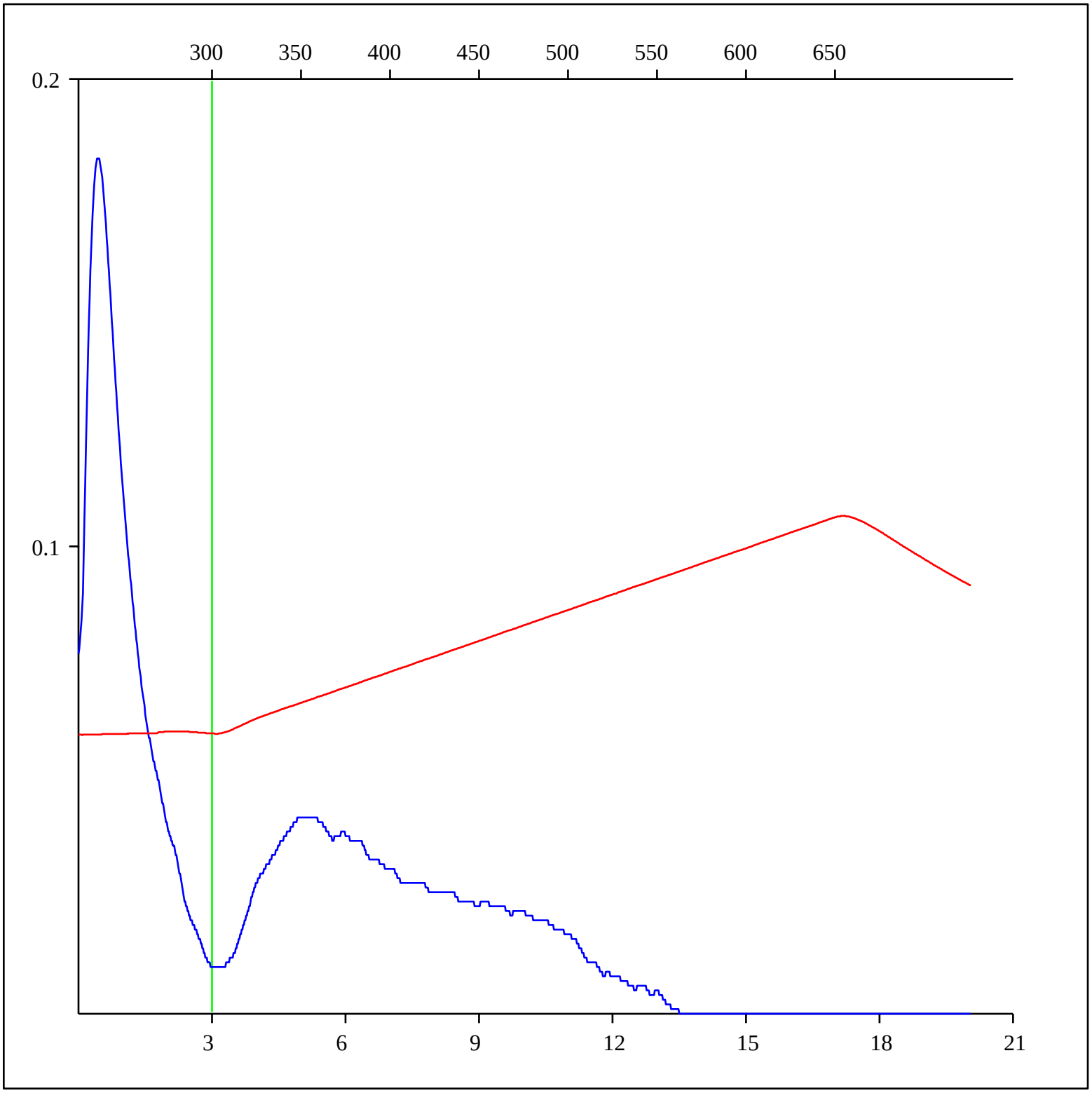
Sample: C-560282
Acquisition Date:
Location: BLOW RIVER YT E-47
Depth: 2267.63 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



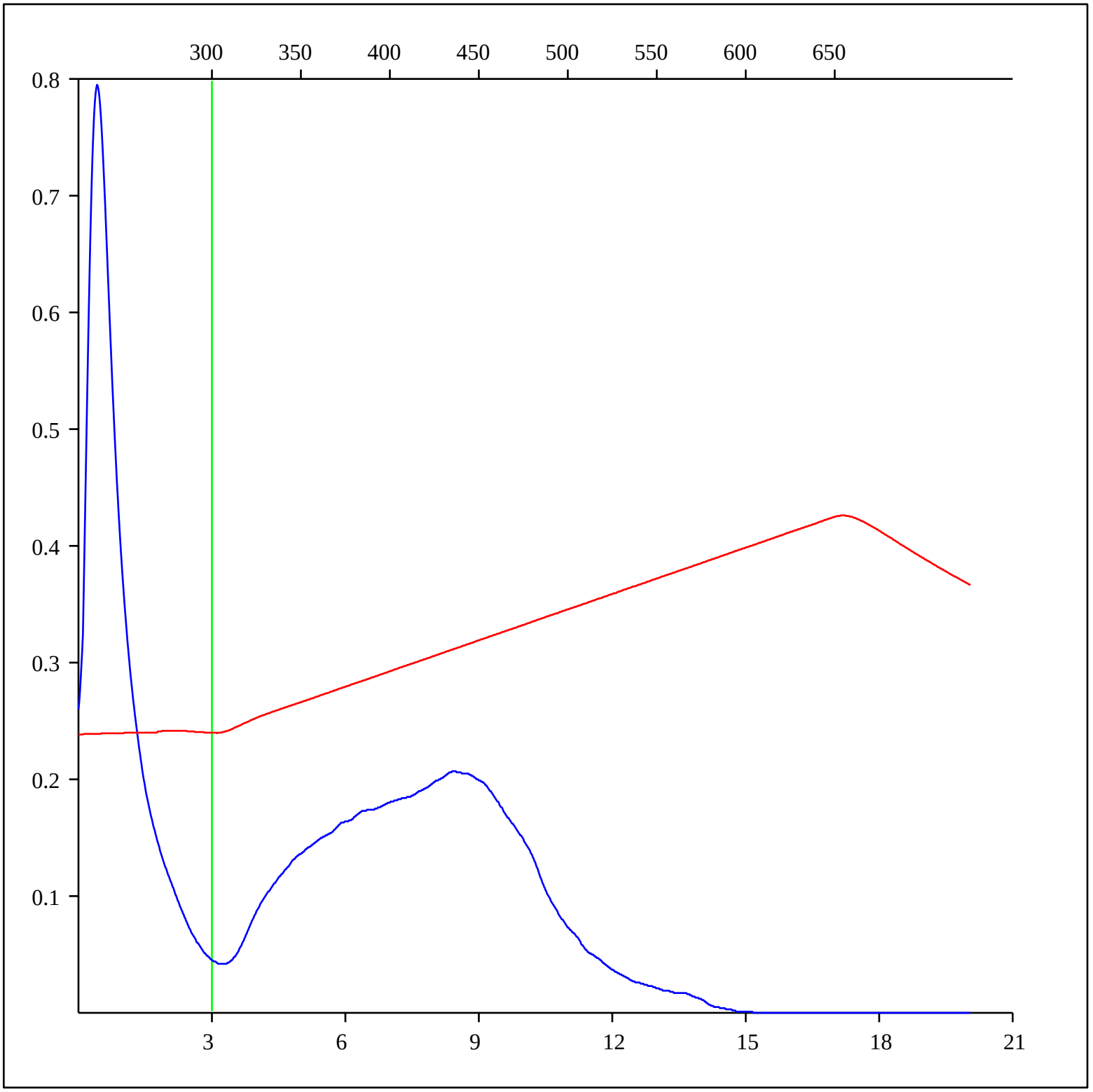
Sample: C-560283
Acquisition Date:
Location: BLOW RIVER YT E-47
Depth: 3052.1 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



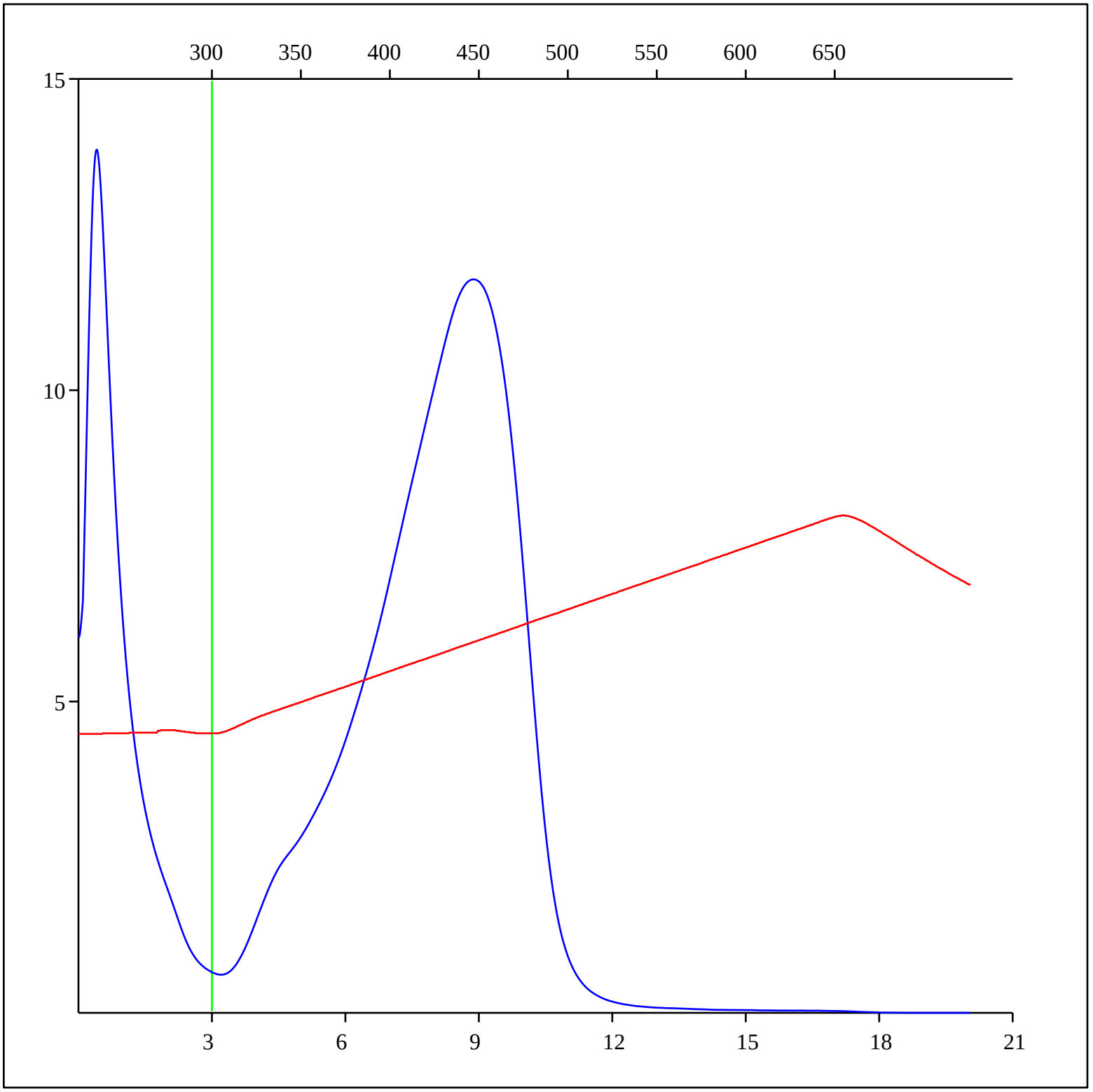
Sample: C-560284
Acquisition Date:
Location: BLOW RIVER YT E-47
Depth: 3969.2 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



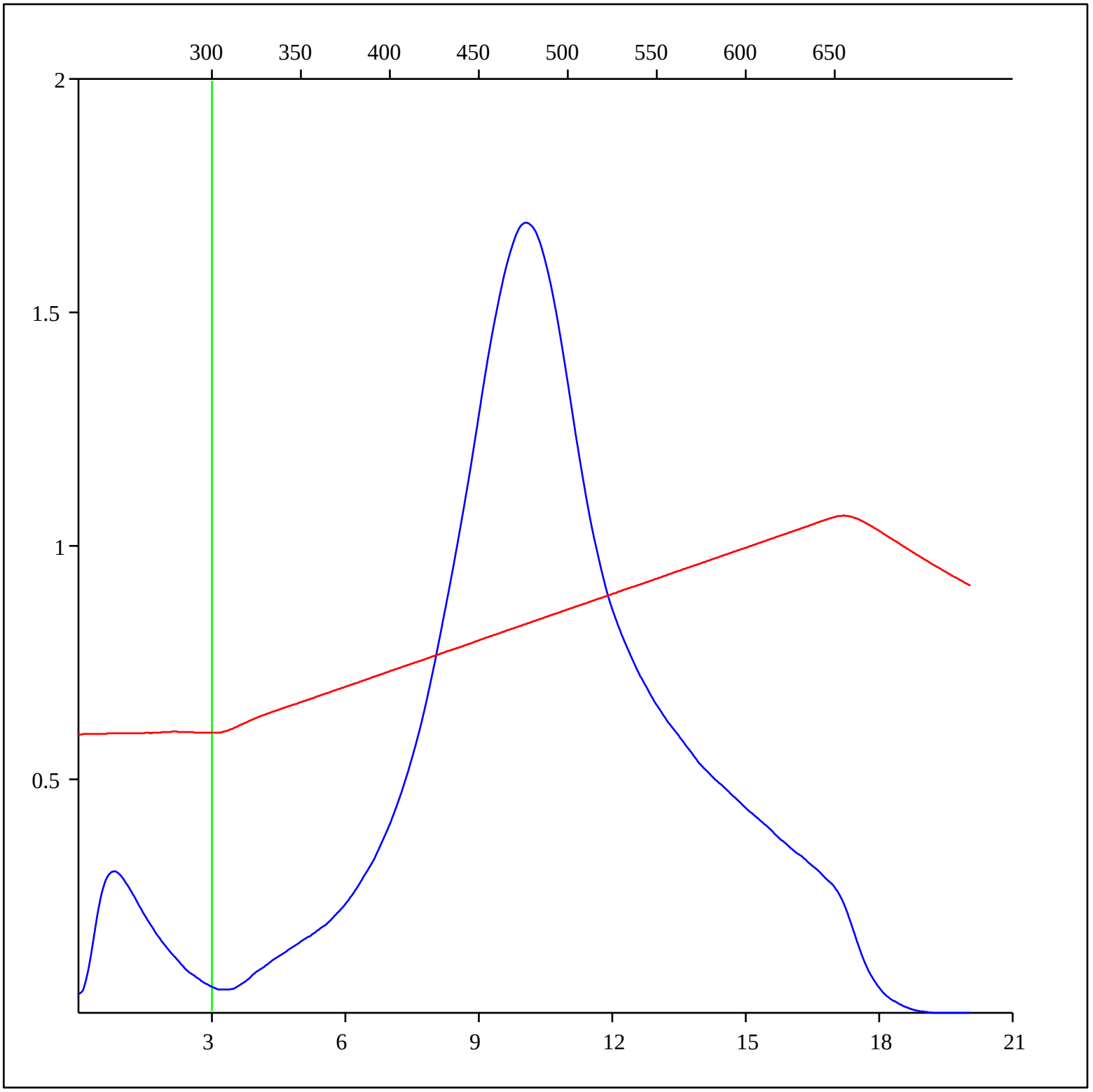
Sample: C-560285
Acquisition Date: 02-AUG-2013
Location: ELLICE O-14
Depth: 551.1 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



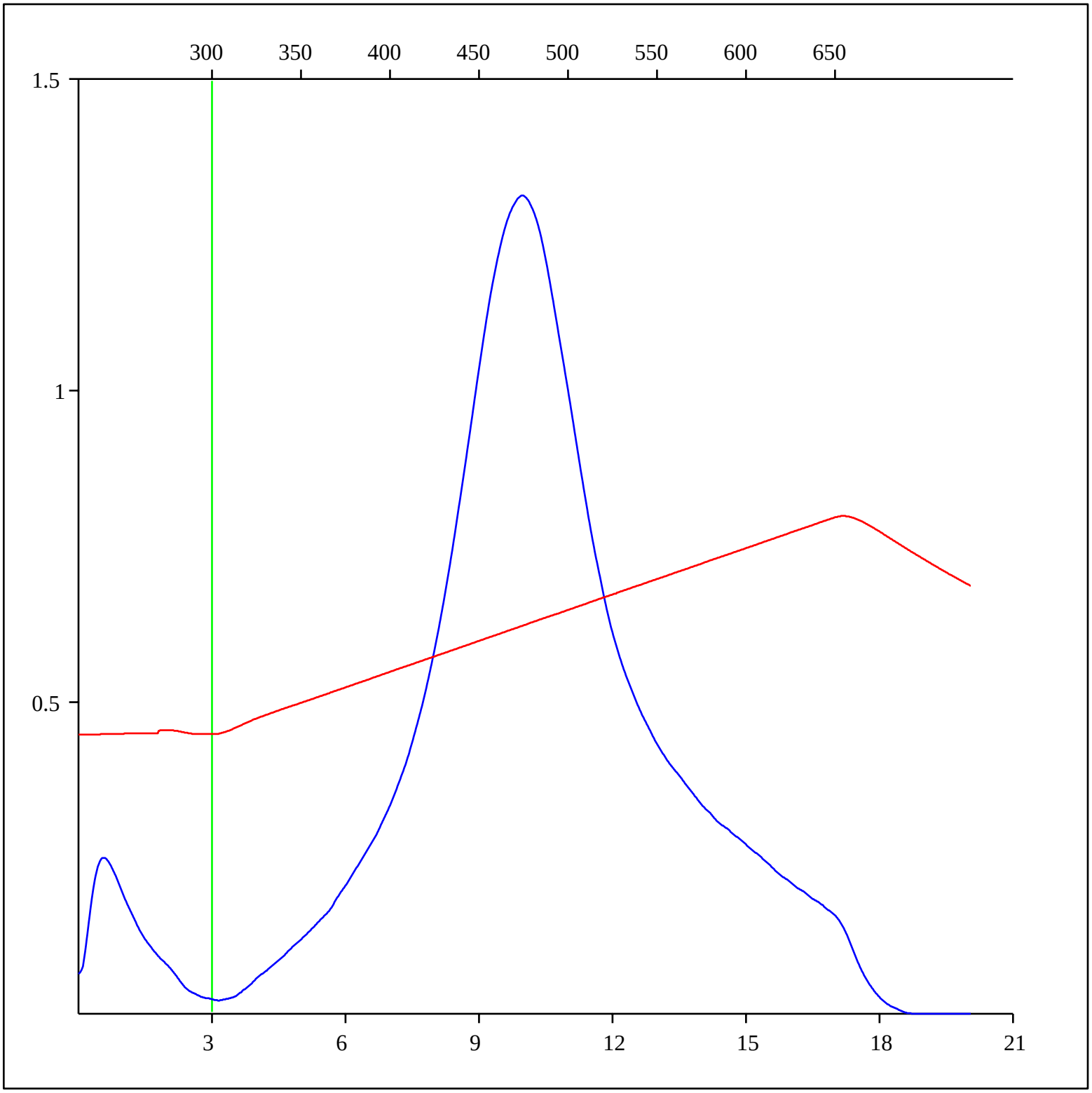
Sample: C-560286
Acquisition Date: 02-AUG-2013
Location: ELLICE O-14
Depth: 1922 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



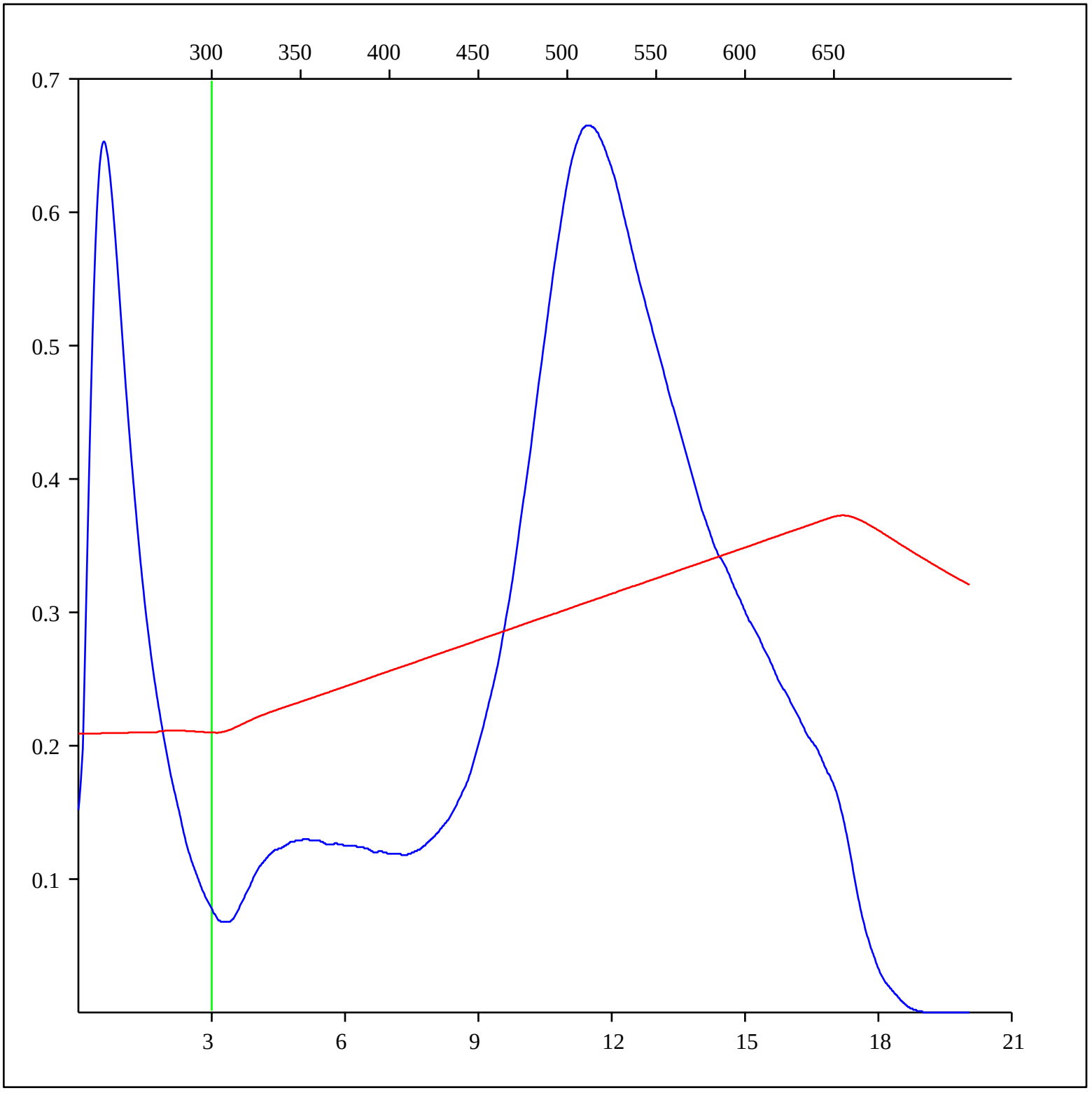
Sample: C-560287
Acquisition Date: 02-AUG-2013
Location: ELLICE O-14
Depth: 2410 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



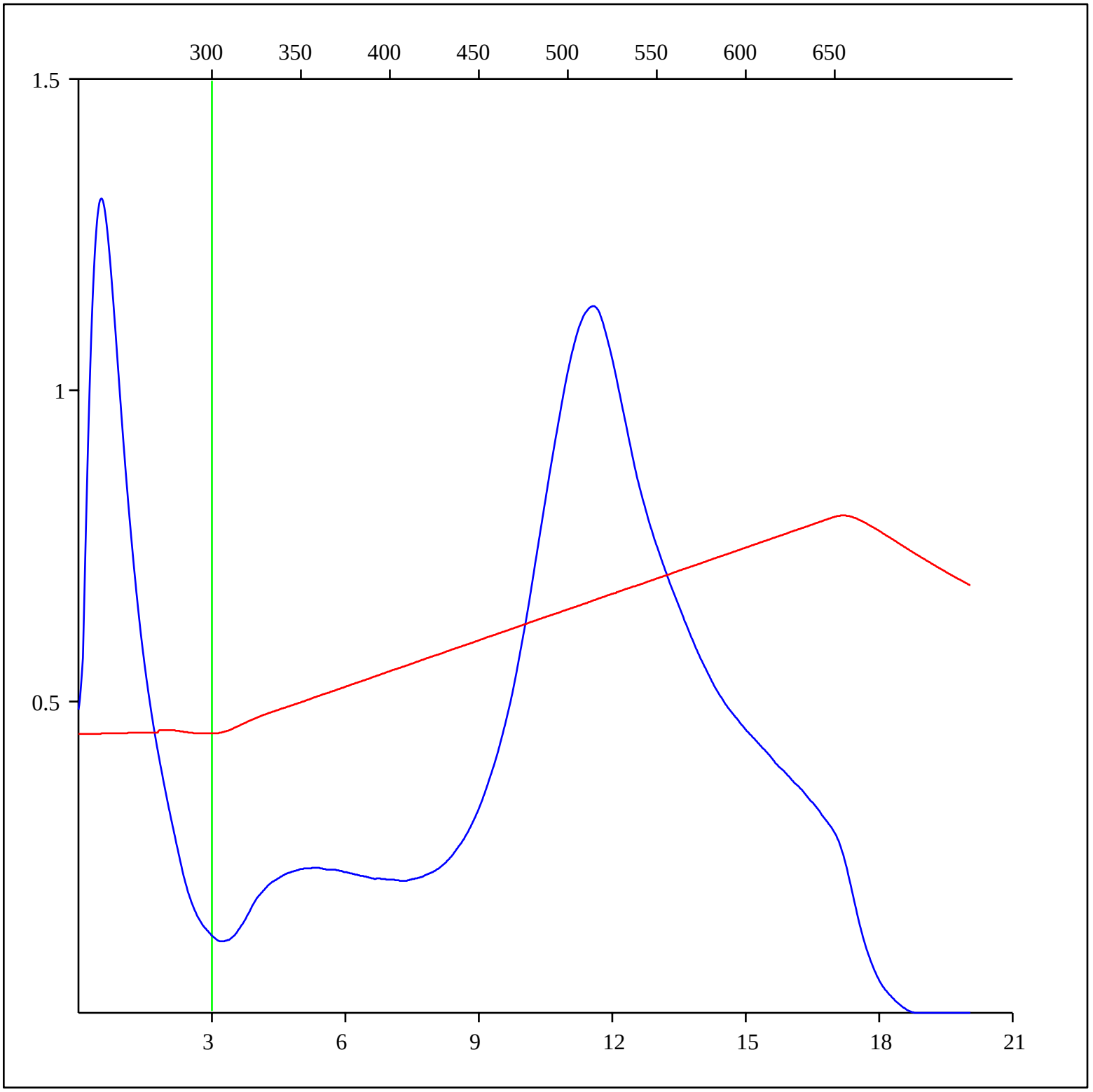
Sample: C-560288
Acquisition Date: 02-AUG-2013
Location: FISH RIVER B-60
Depth: 2456.7 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



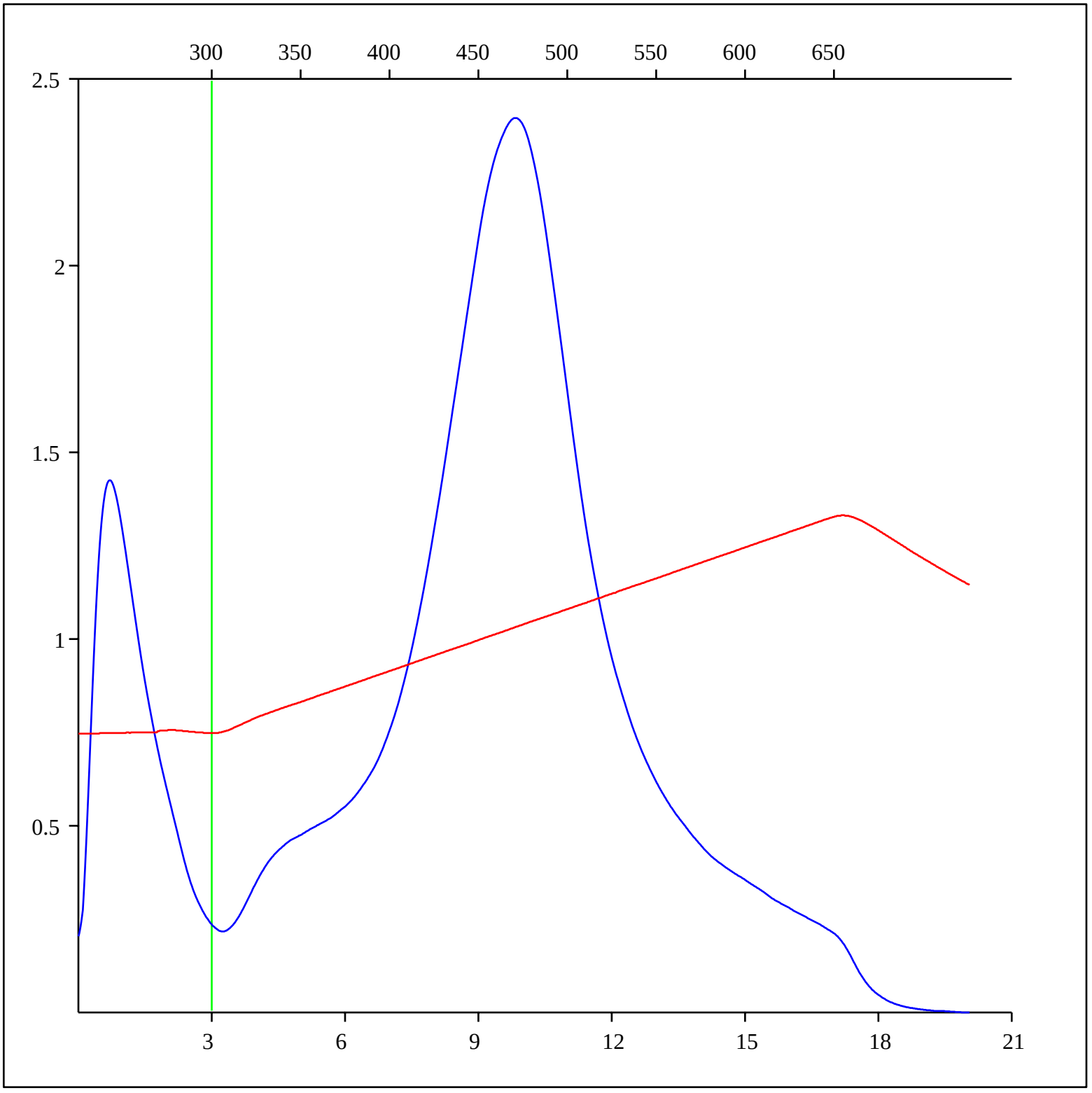
Sample: C-560289
Acquisition Date: 02-AUG-2013
Location: FISH RIVER B-60
Depth: 2633.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



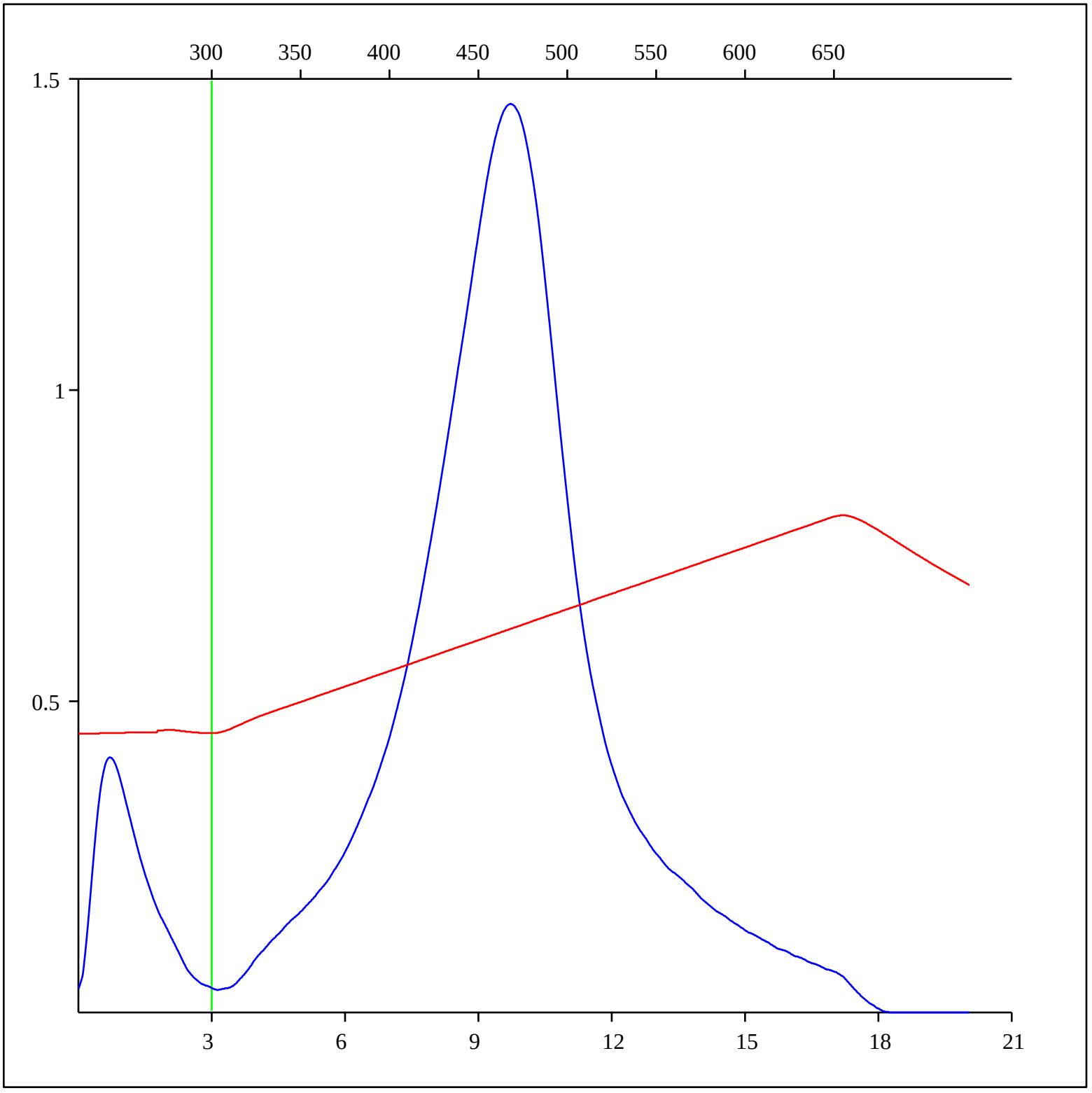
Sample: C-560290
Acquisition Date: 02-AUG-2013
Location: GARRY P-04
Depth: 3004.9 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



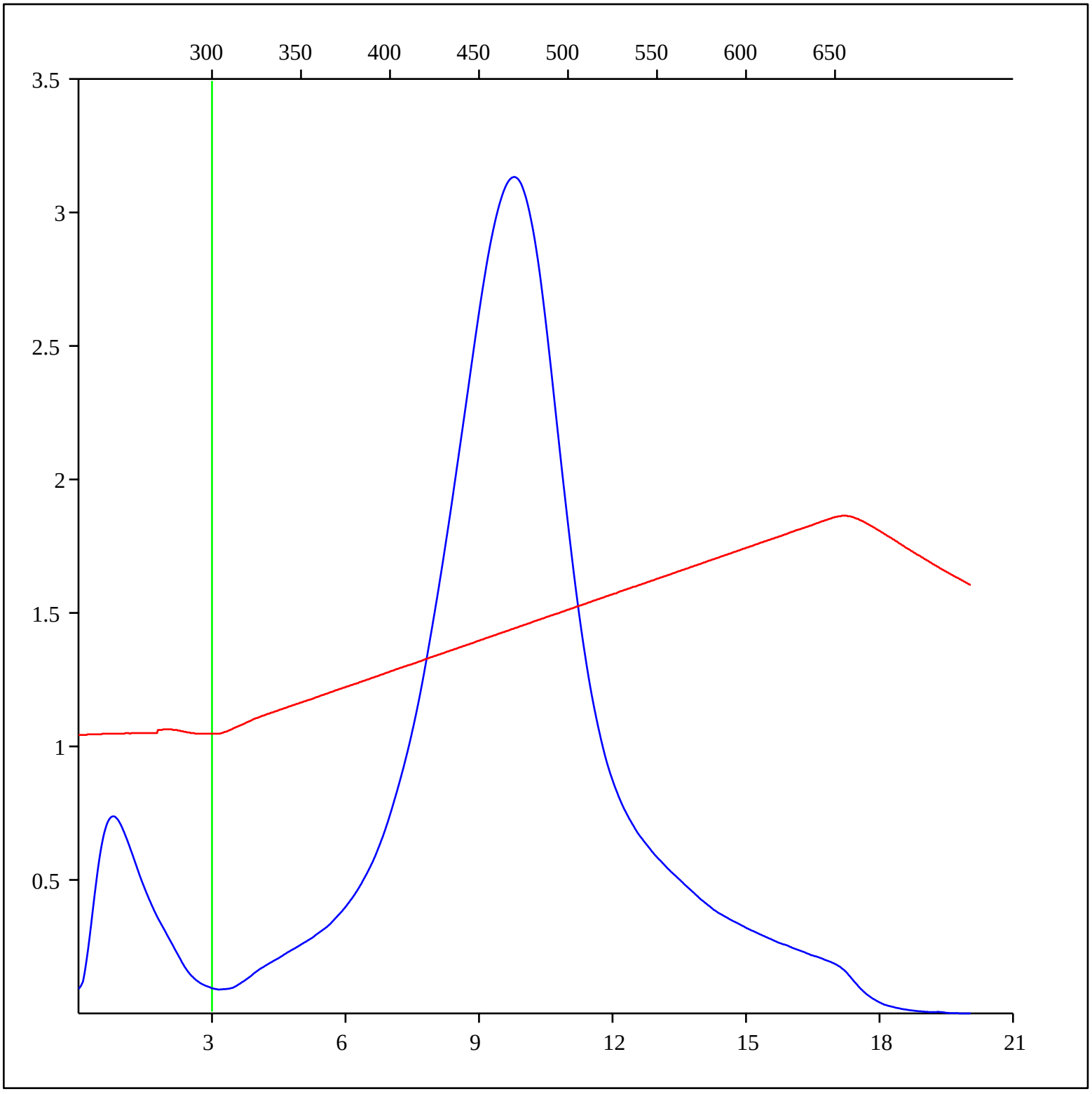
Sample: C-560291
Acquisition Date: 02-AUG-2013
Location: ISSUNGNAK 2O-61
Depth: 2406.15 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



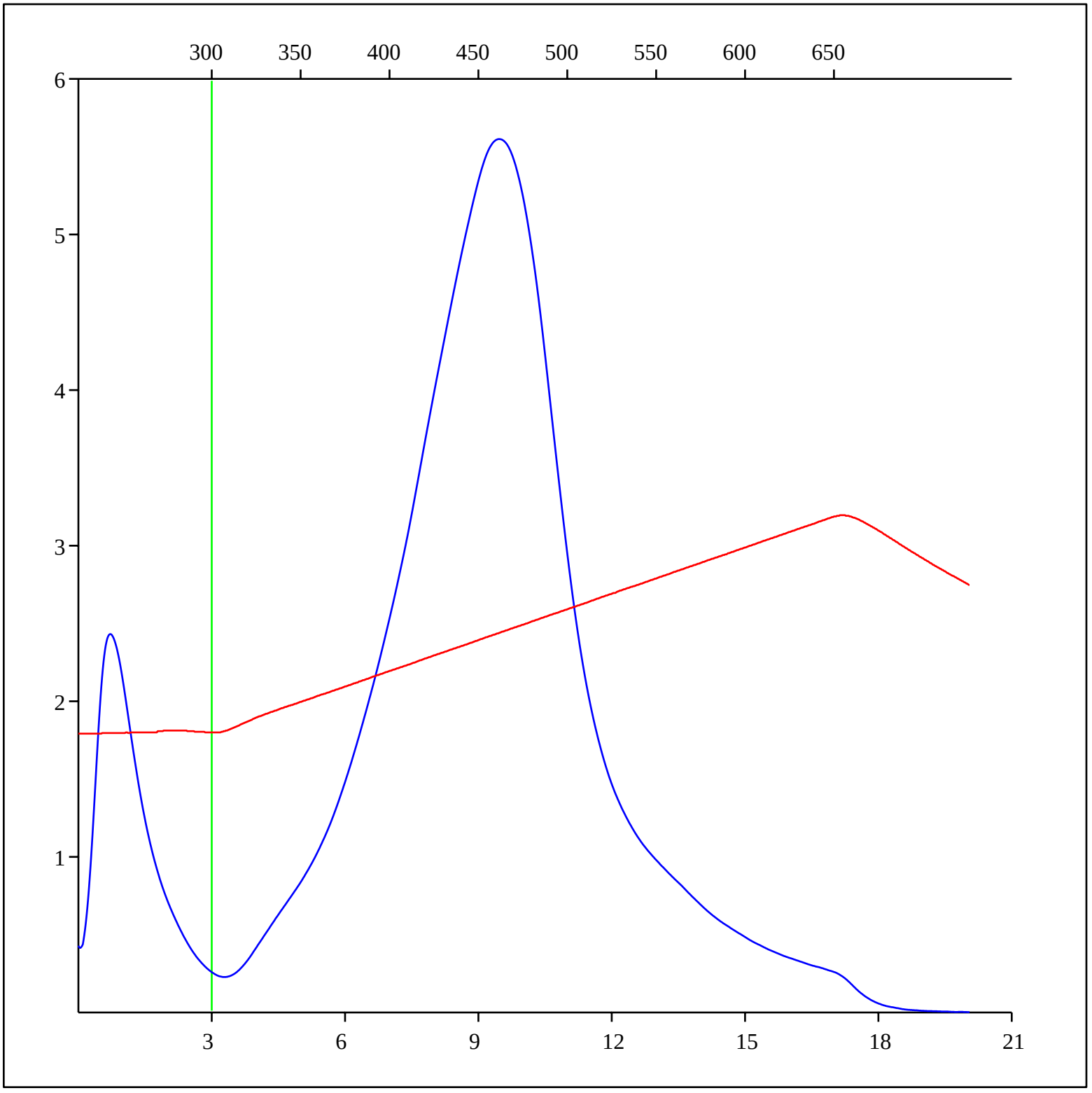
Sample: C-560292
Acquisition Date: 02-AUG-2013
Location: ISSUNGNAK 2O-61
Depth: 3279.05 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



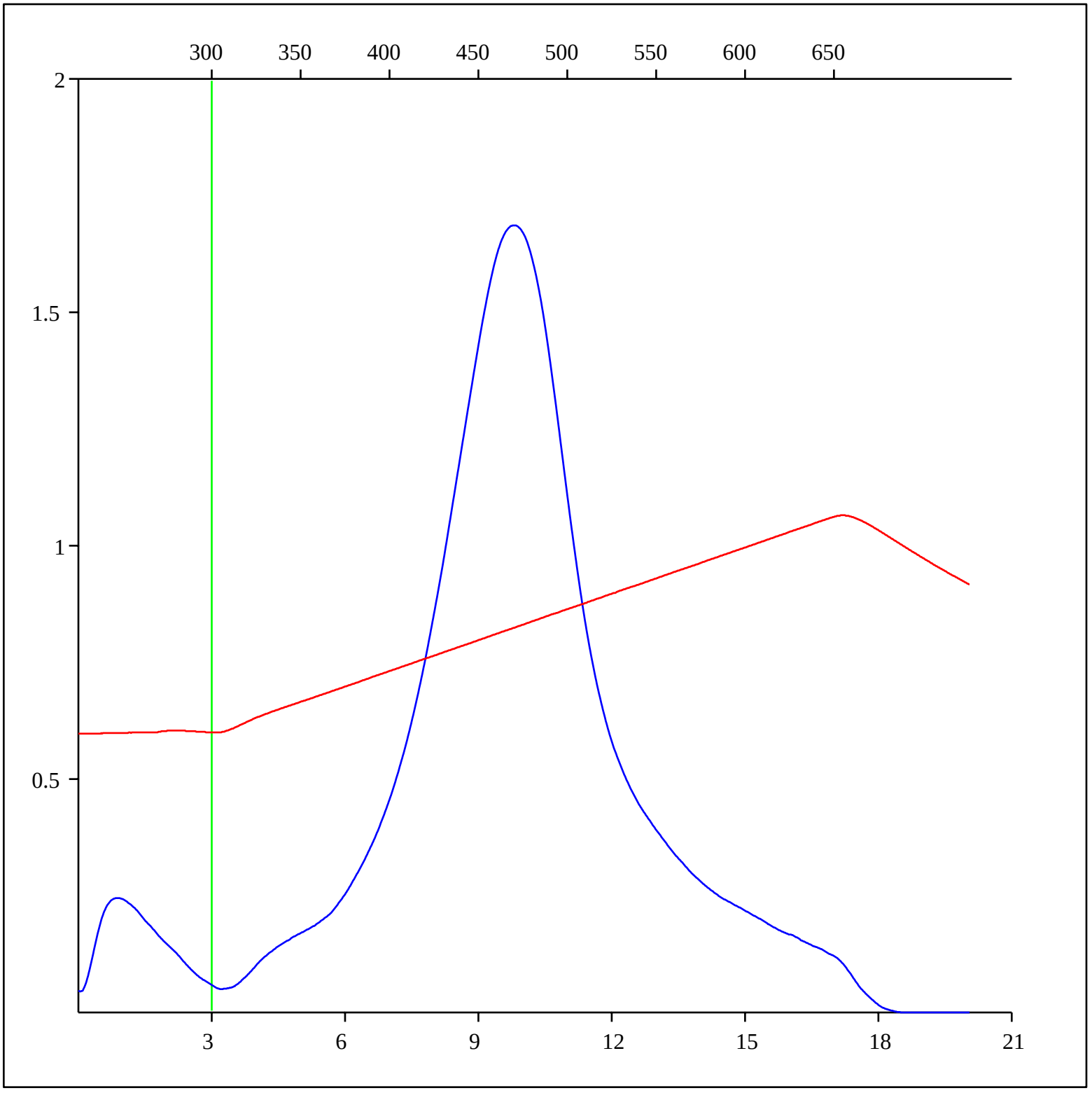
Sample: C-560293
Acquisition Date: 02-AUG-2013
Location: ITIYOK I-27
Depth: 1838.8 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



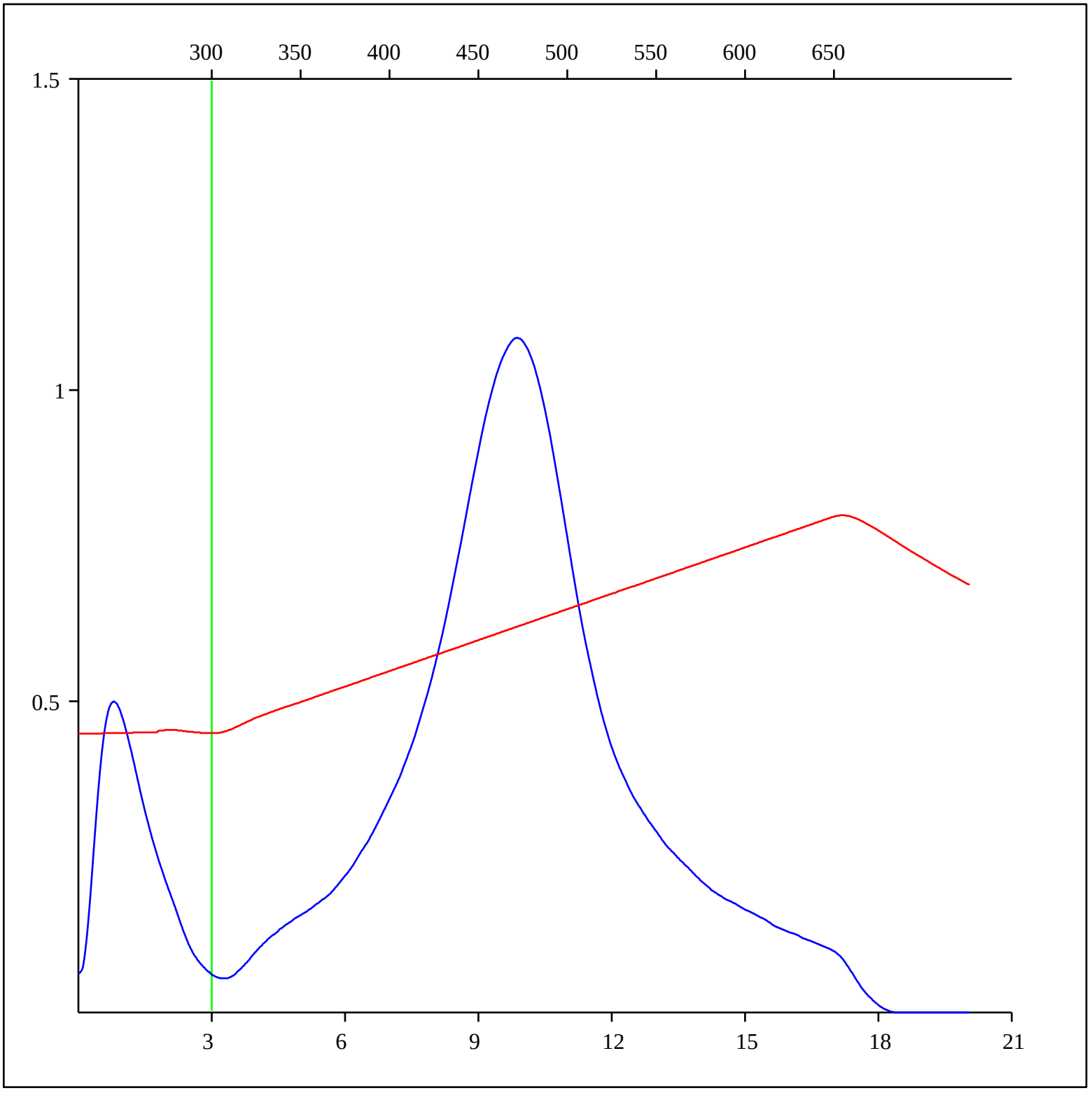
Sample: C-560294
Acquisition Date: 02-AUG-2013
Location: IVIK J-26
Depth: 3117.1 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



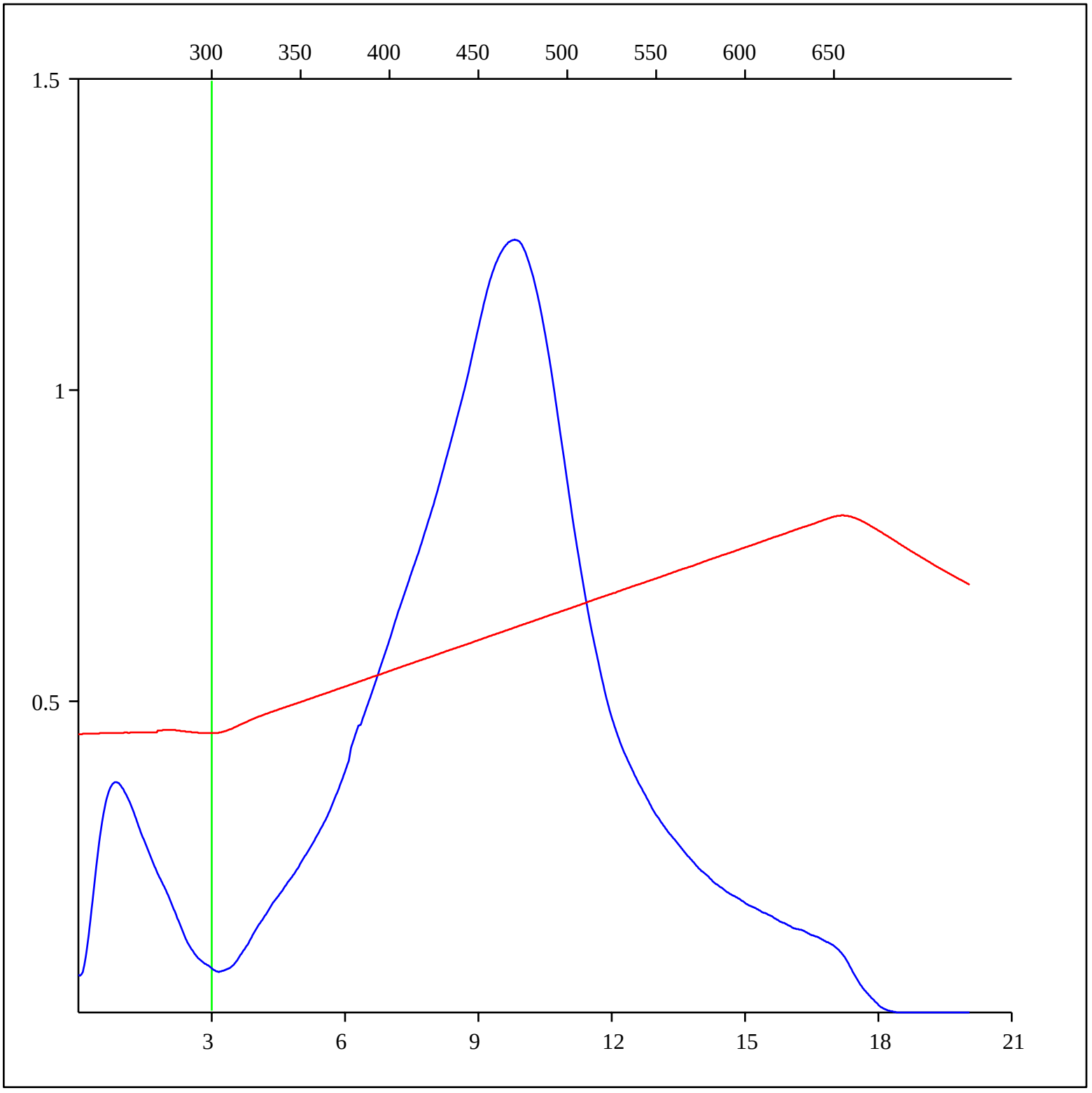
Sample: C-560295
Acquisition Date: 02-AUG-2013
Location: IVIK J-26
Depth: 3468.9 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



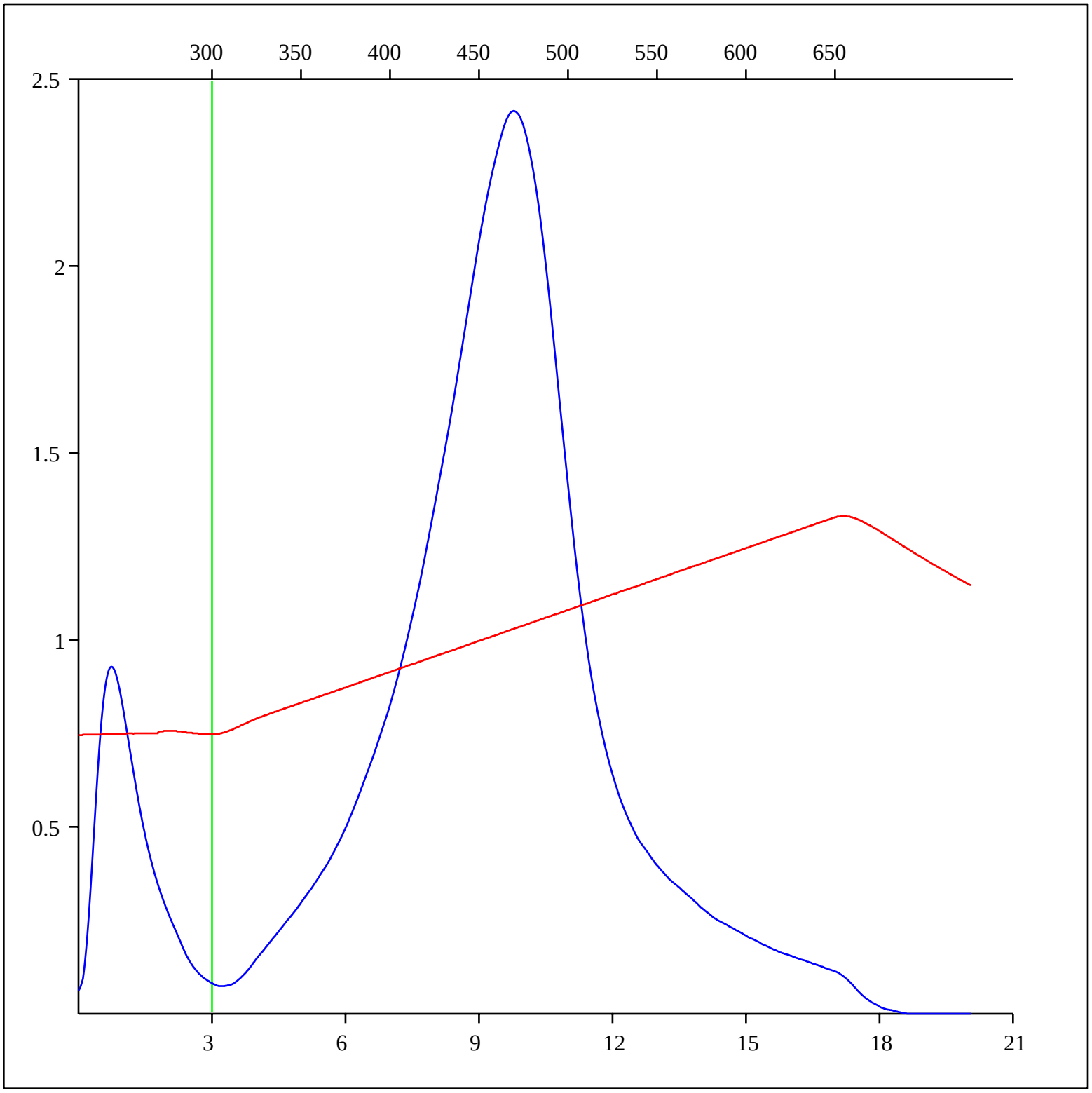
Sample: C-560296
Acquisition Date: 02-AUG-2013
Location: IVIK K-54
Depth: 2922.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



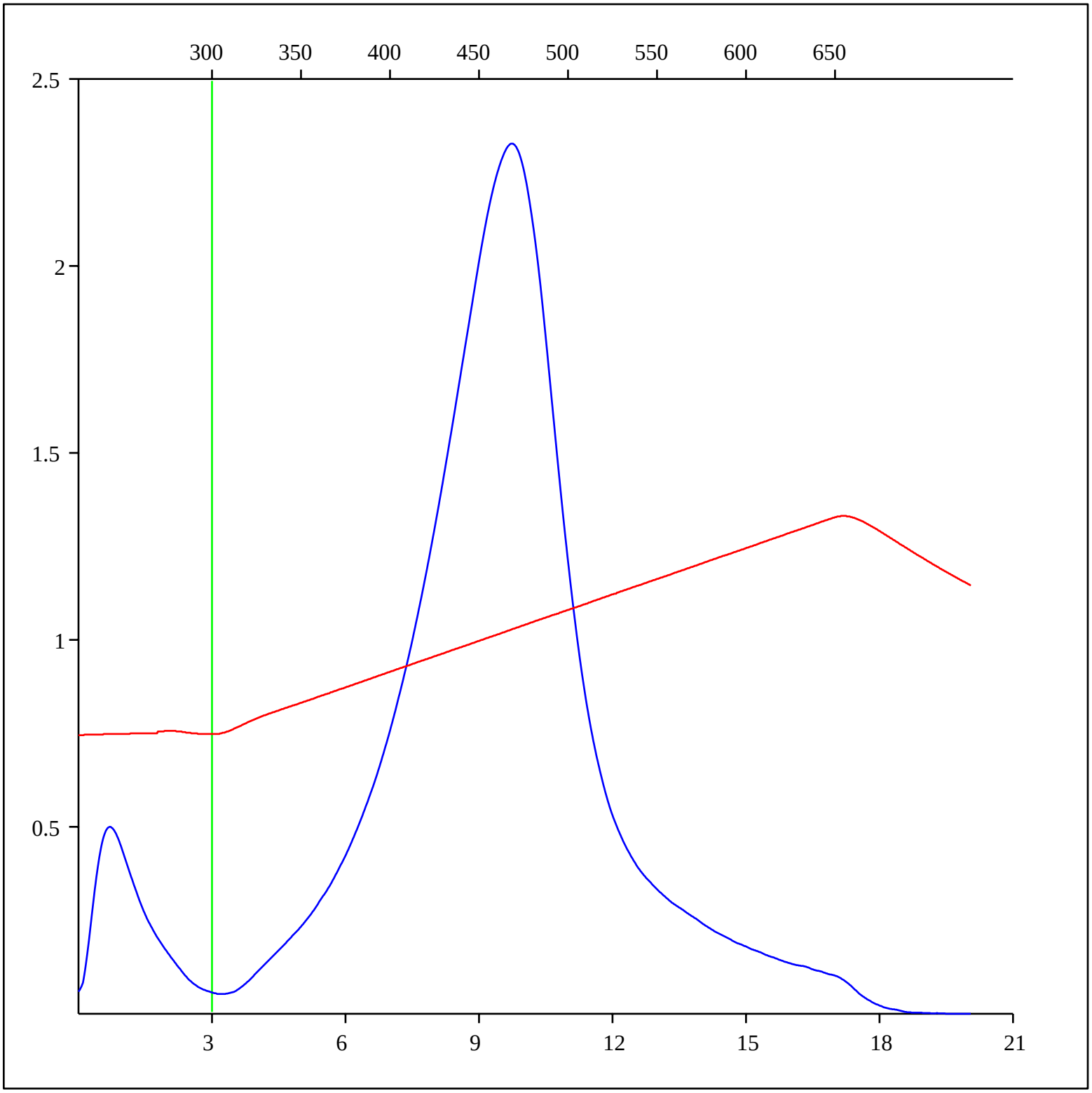
Sample: C-560297
Acquisition Date: 02-AUG-2013
Location: KADLUK O-07
Depth: 1494.4 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



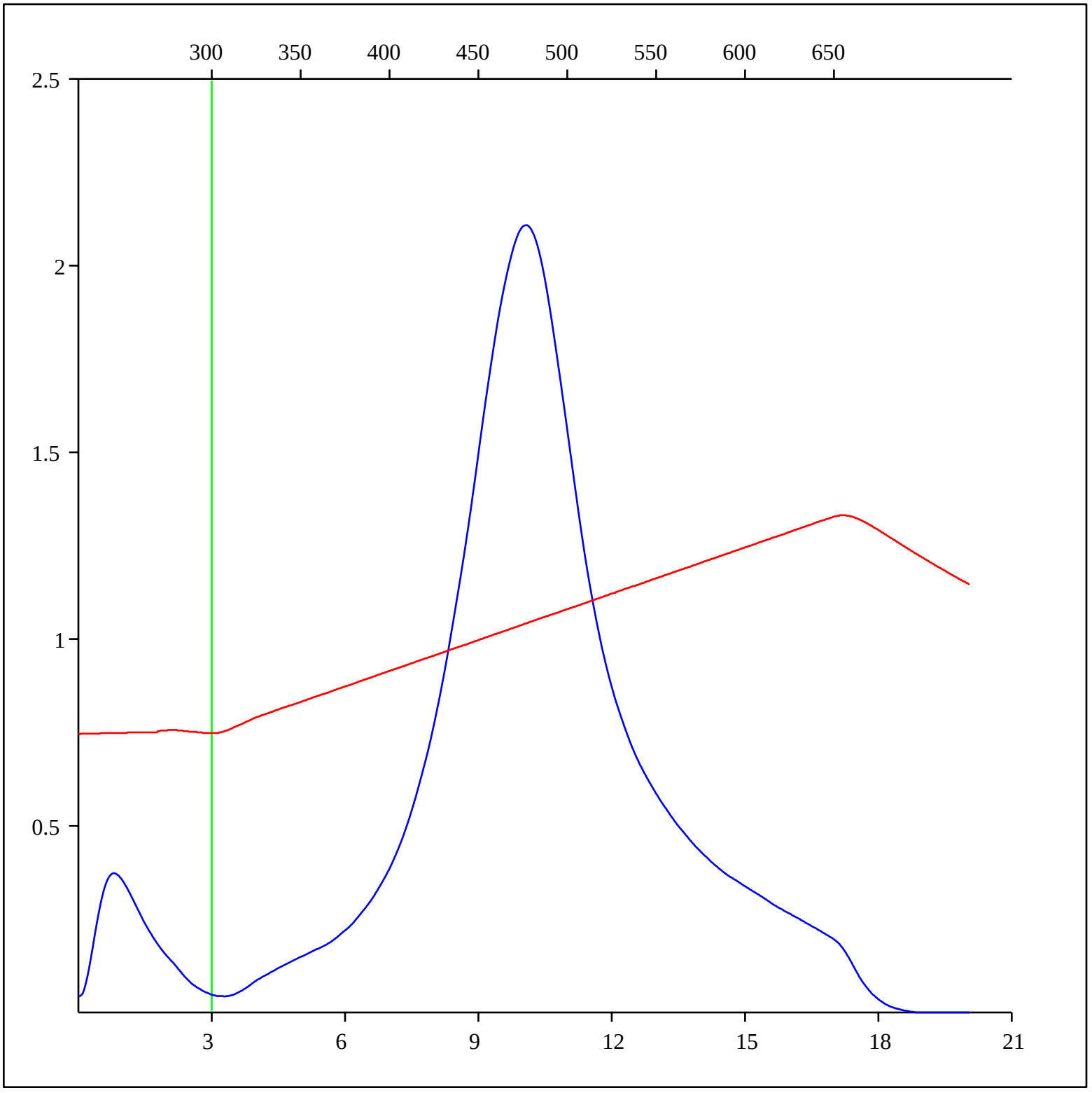
Sample: C-560298
Acquisition Date: 02-AUG-2013
Location: KADLUK O-07
Depth: 1749.85 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



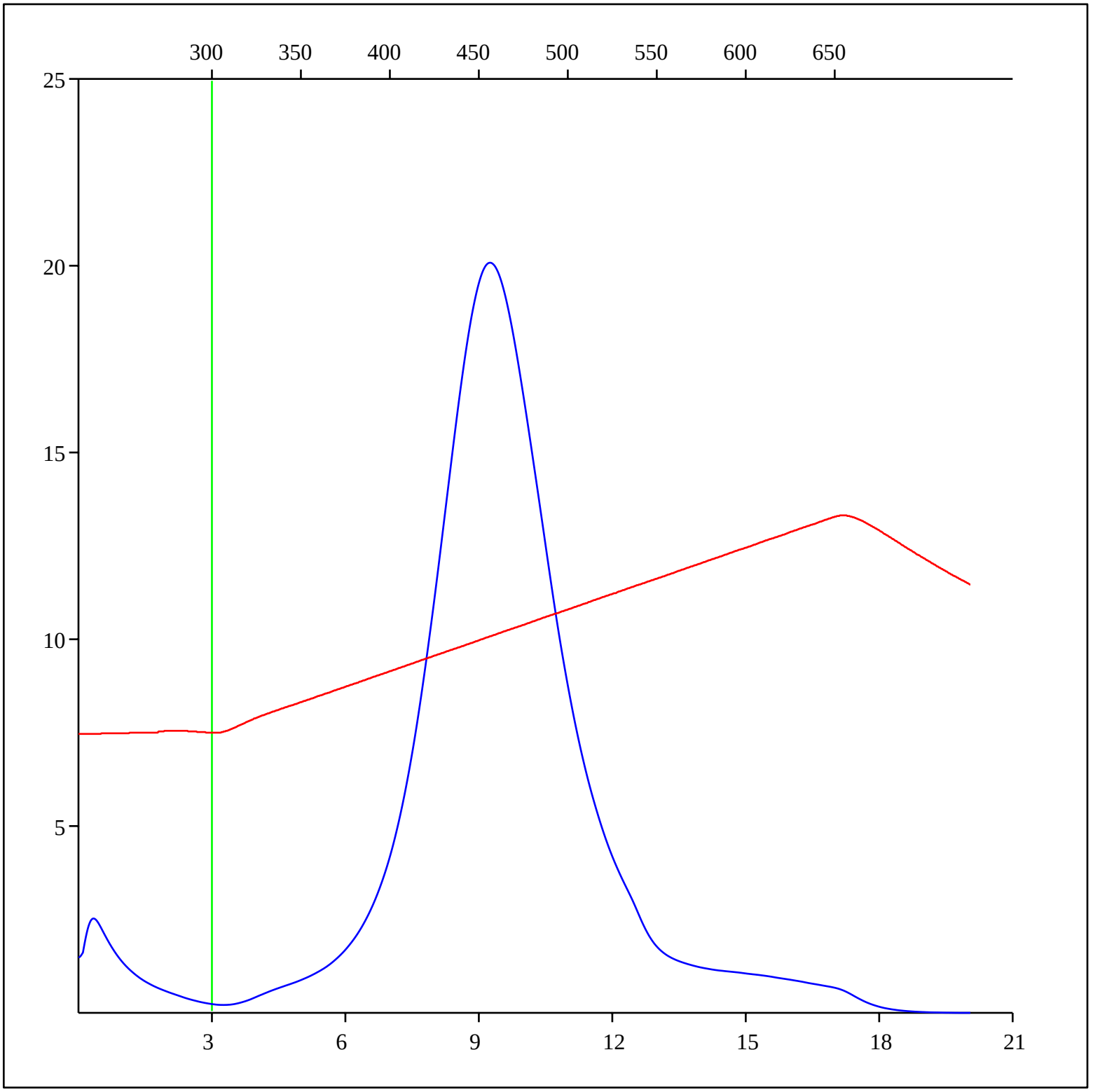
Sample: C-560299
Acquisition Date: 02-AUG-2013
Location: KIMIK D-29
Depth: 2332.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



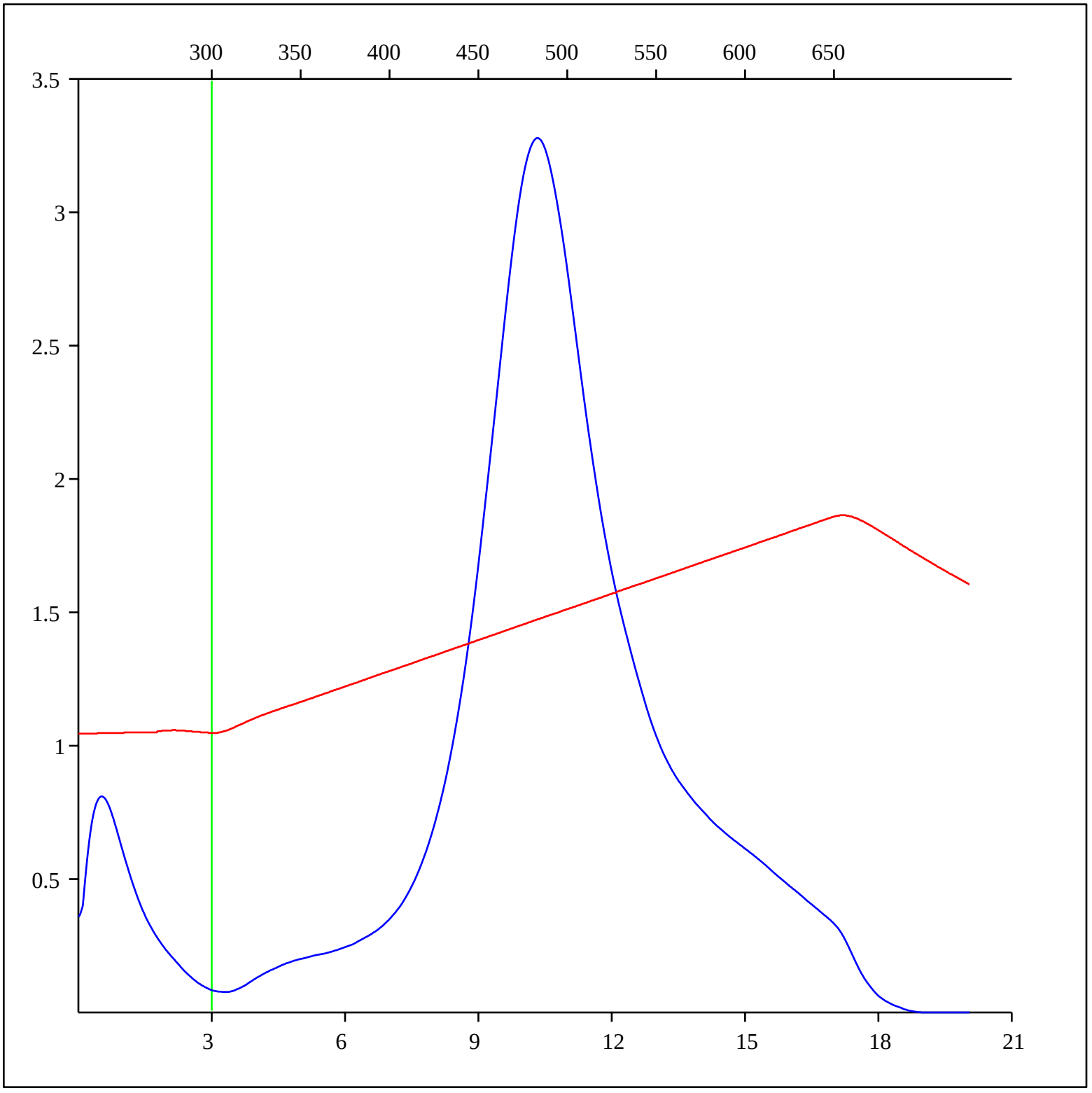
Sample: C-560300
Acquisition Date: 02-AUG-2013
Location: KIMIK D-29
Depth: 2583.69 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



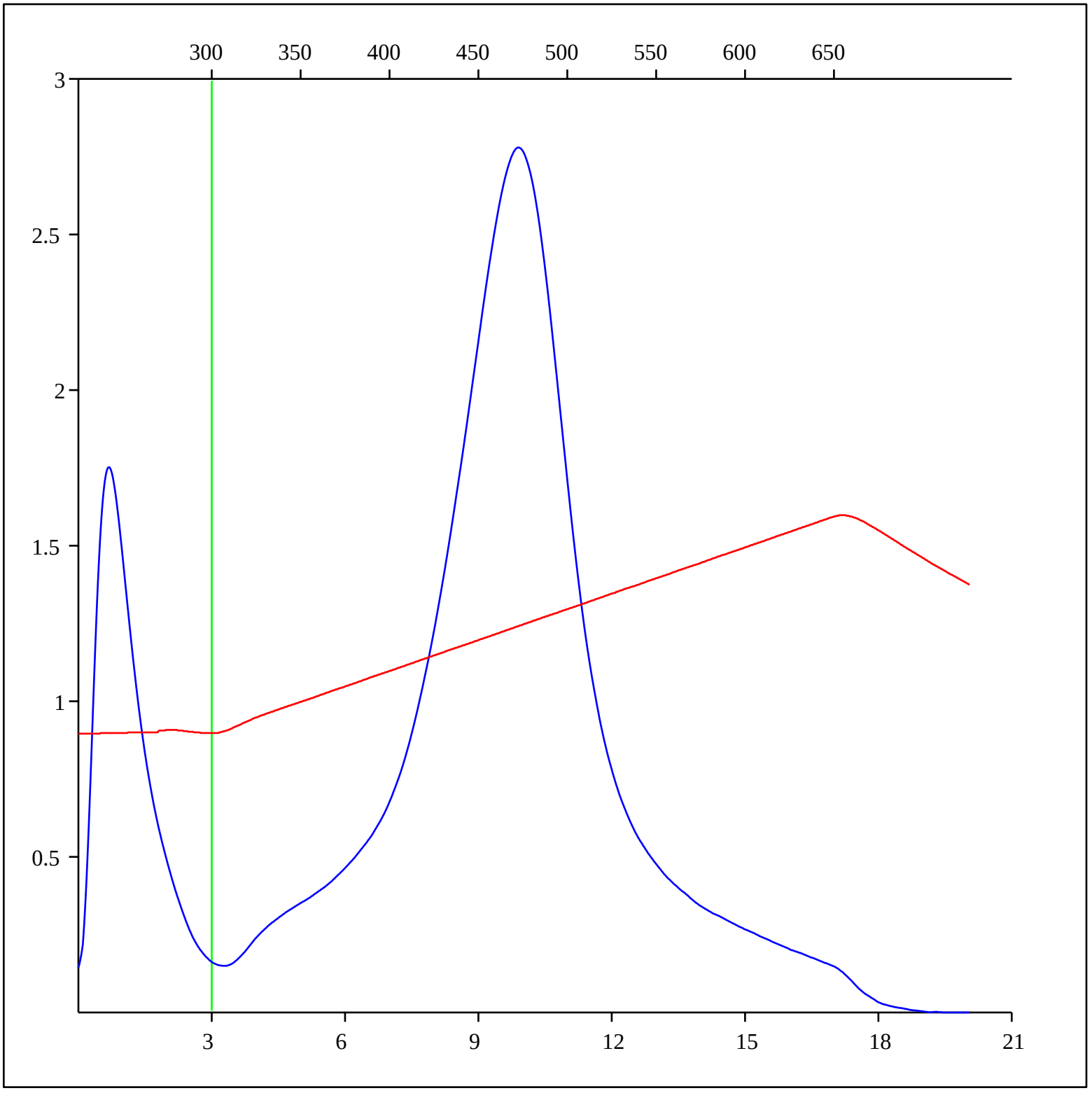
Sample: C-560301
Acquisition Date: 02-AUG-2013
Location: KIPNIK O-20
Depth: 1797.75 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



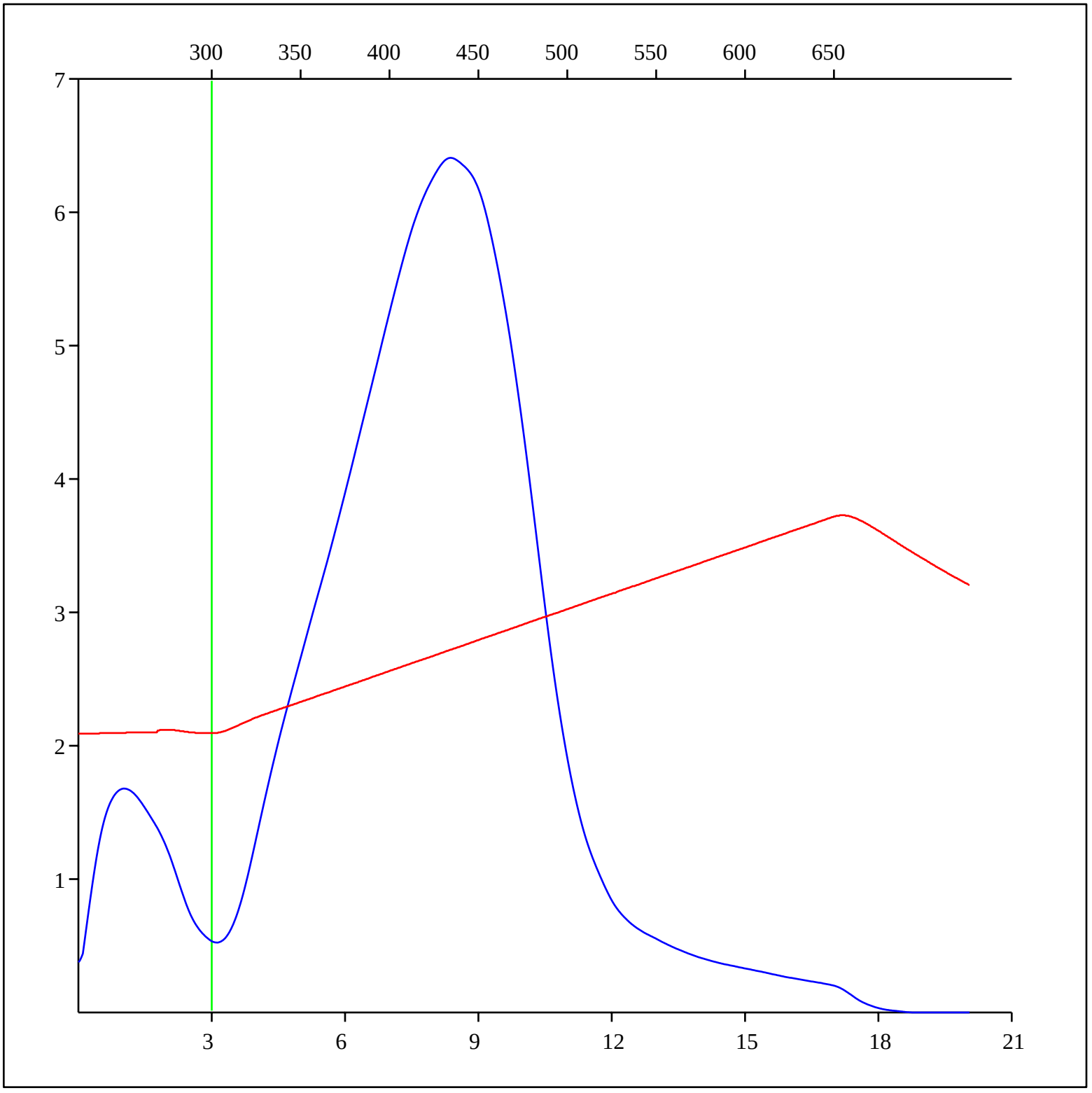
Sample: C-560302
Acquisition Date: 02-AUG-2013
Location: KOPANOAR 2I-44
Depth: 3760.87 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



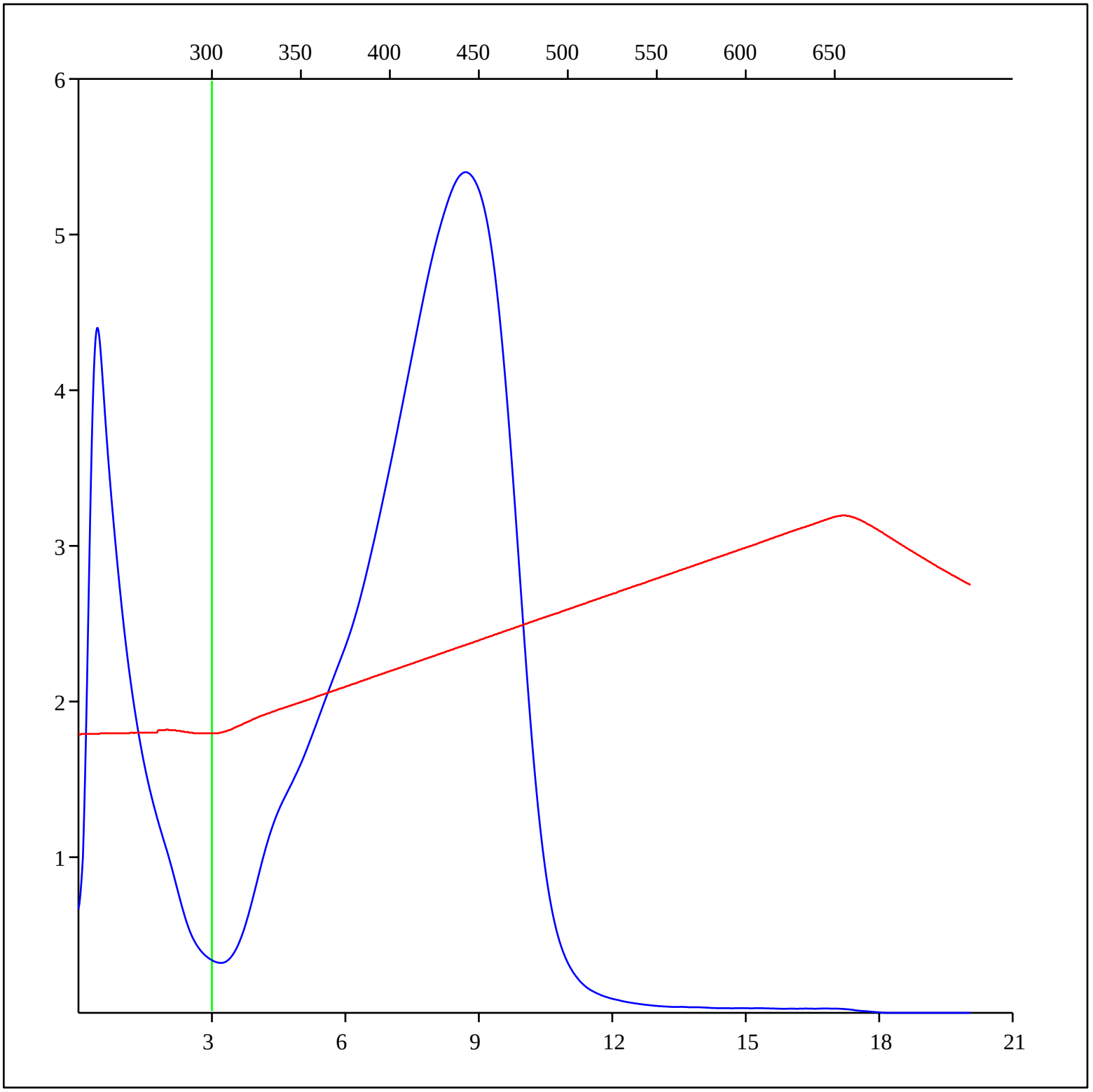
Sample: C-560303
Acquisition Date: 02-AUG-2013
Location: KUGMALLIT H-59
Depth: 1629.3 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



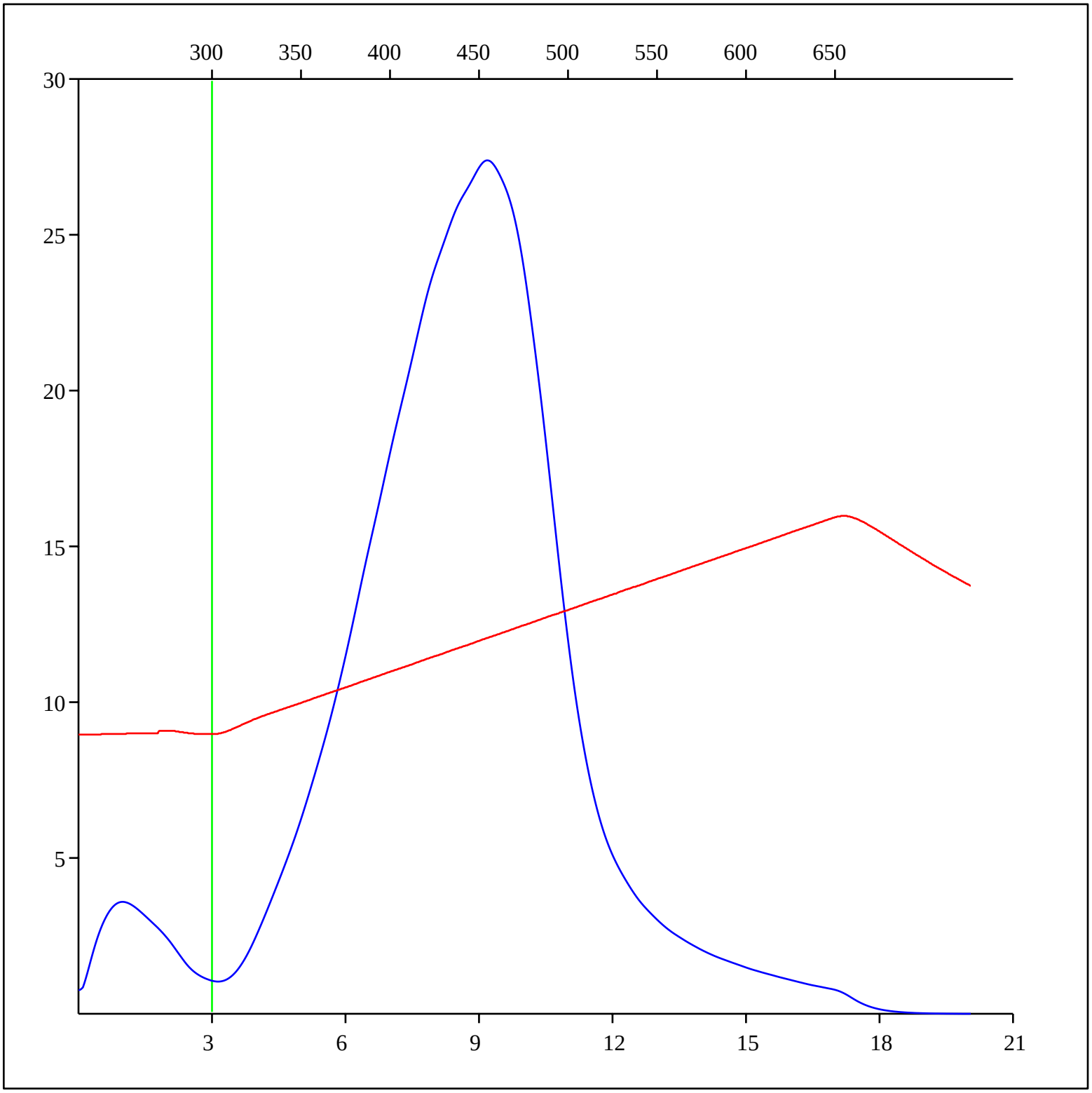
Sample: C-560304
Acquisition Date: 02-AUG-2013
Location: KUGMALLIT H-59
Depth: 1636.9 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



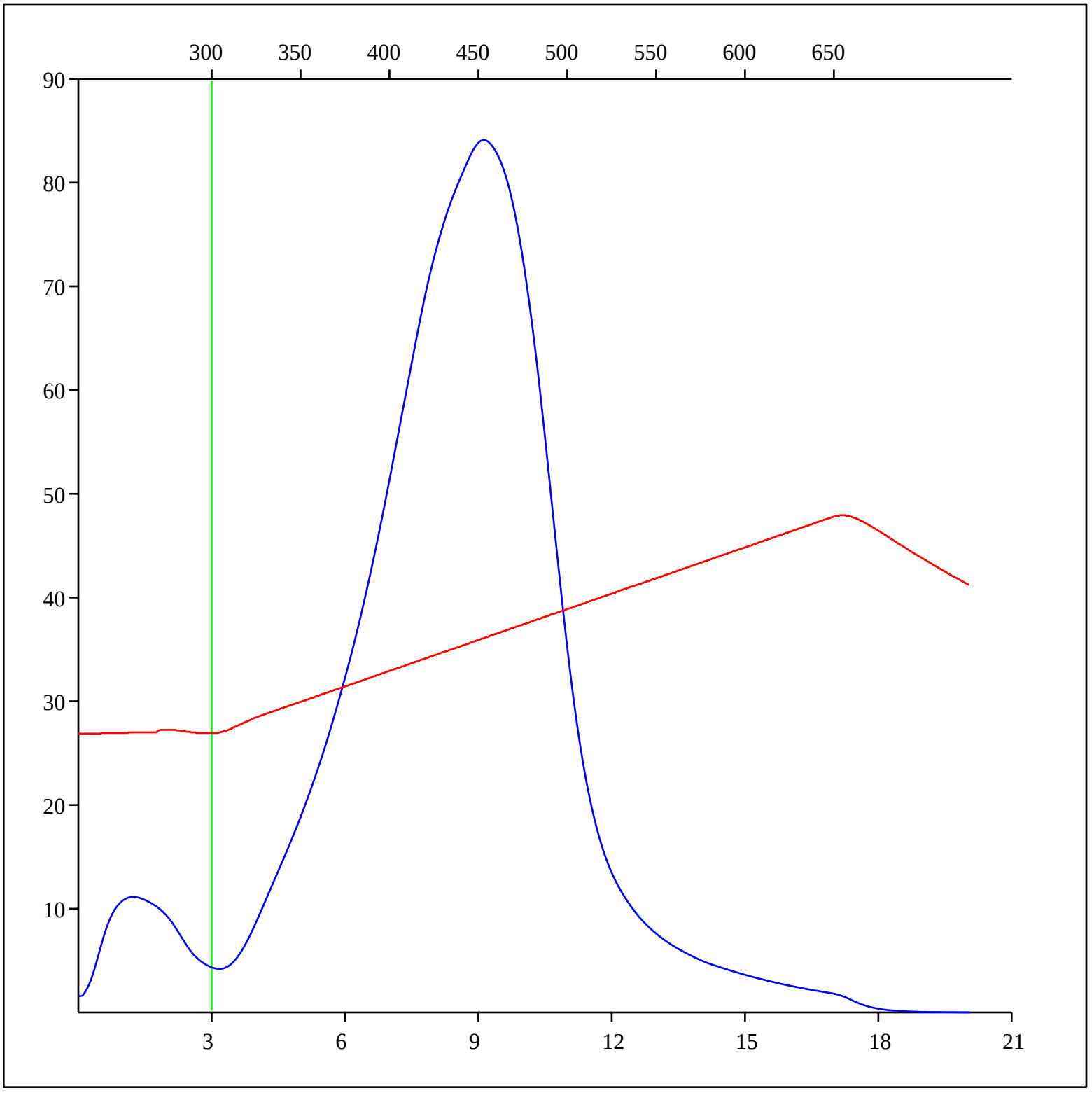
Sample: C-560305
Acquisition Date: 02-AUG-2013
Location: KUGMALLIT H-59
Depth: 1738.38 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



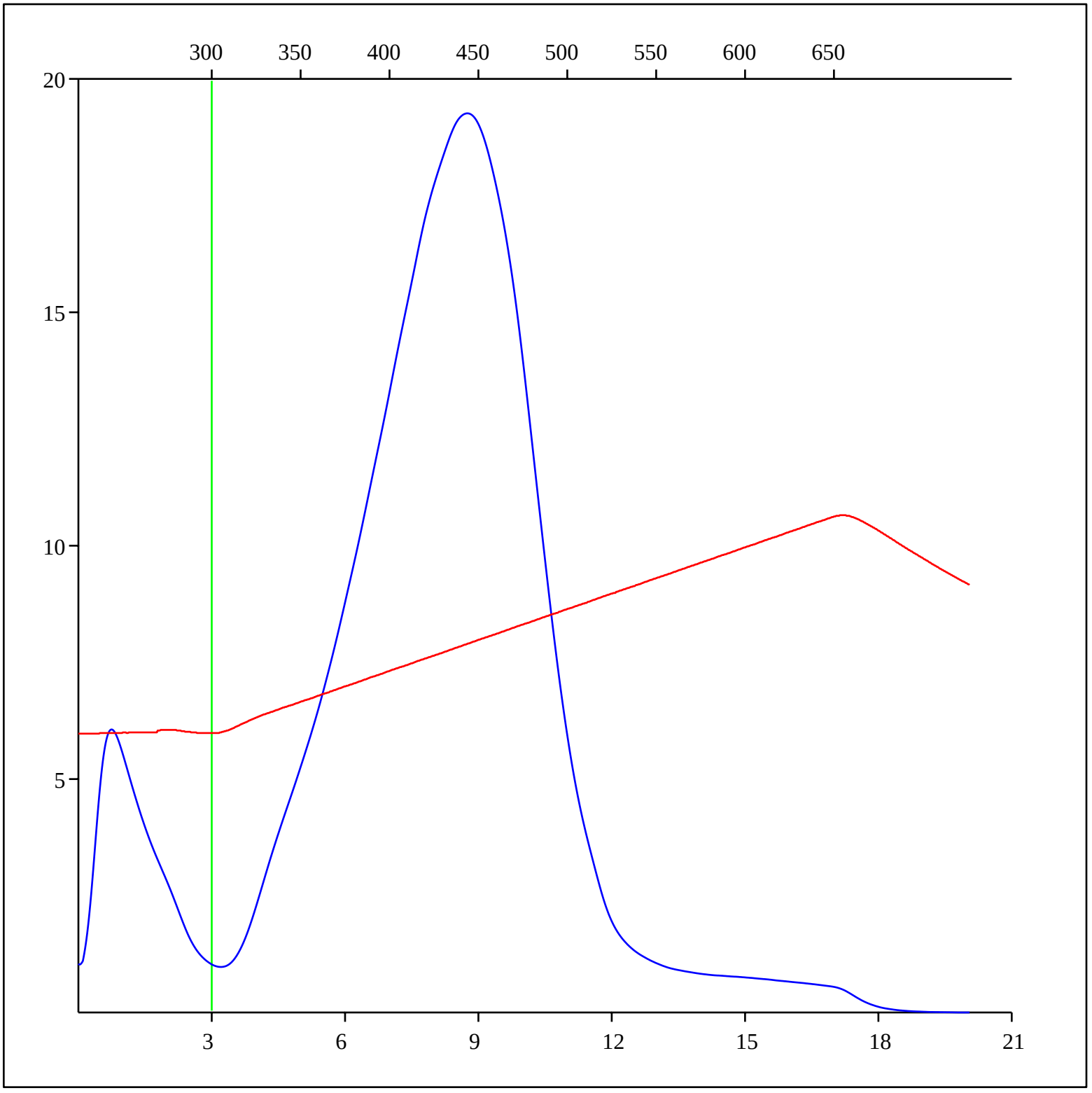
Sample: C-560306
Acquisition Date: 02-AUG-2013
Location: KUGMALLIT H-59
Depth: 1742.85 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



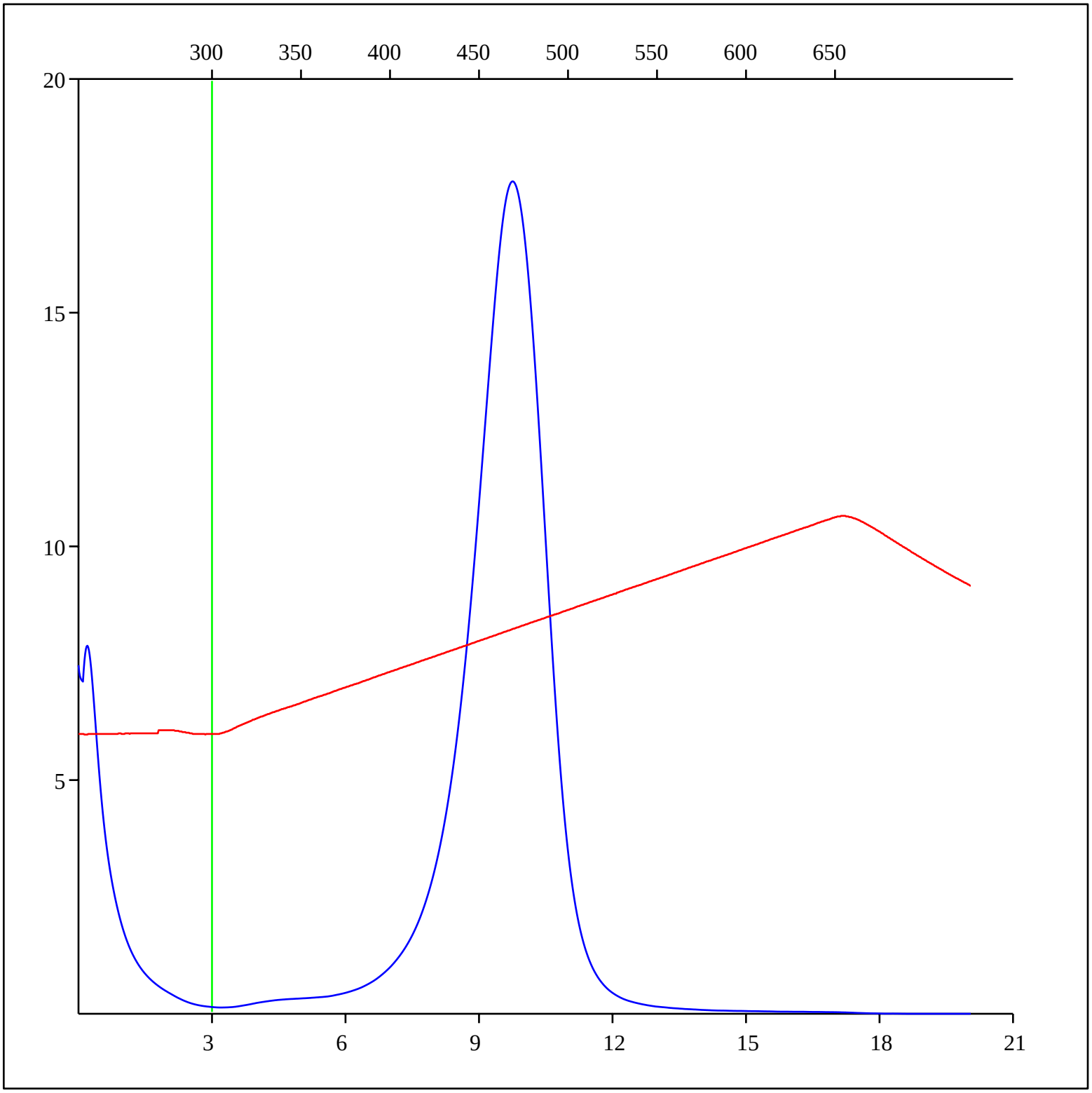
Sample: C-560307
Acquisition Date: 02-AUG-2013
Location: KUGMALLIT H-59
Depth: 1743.8 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



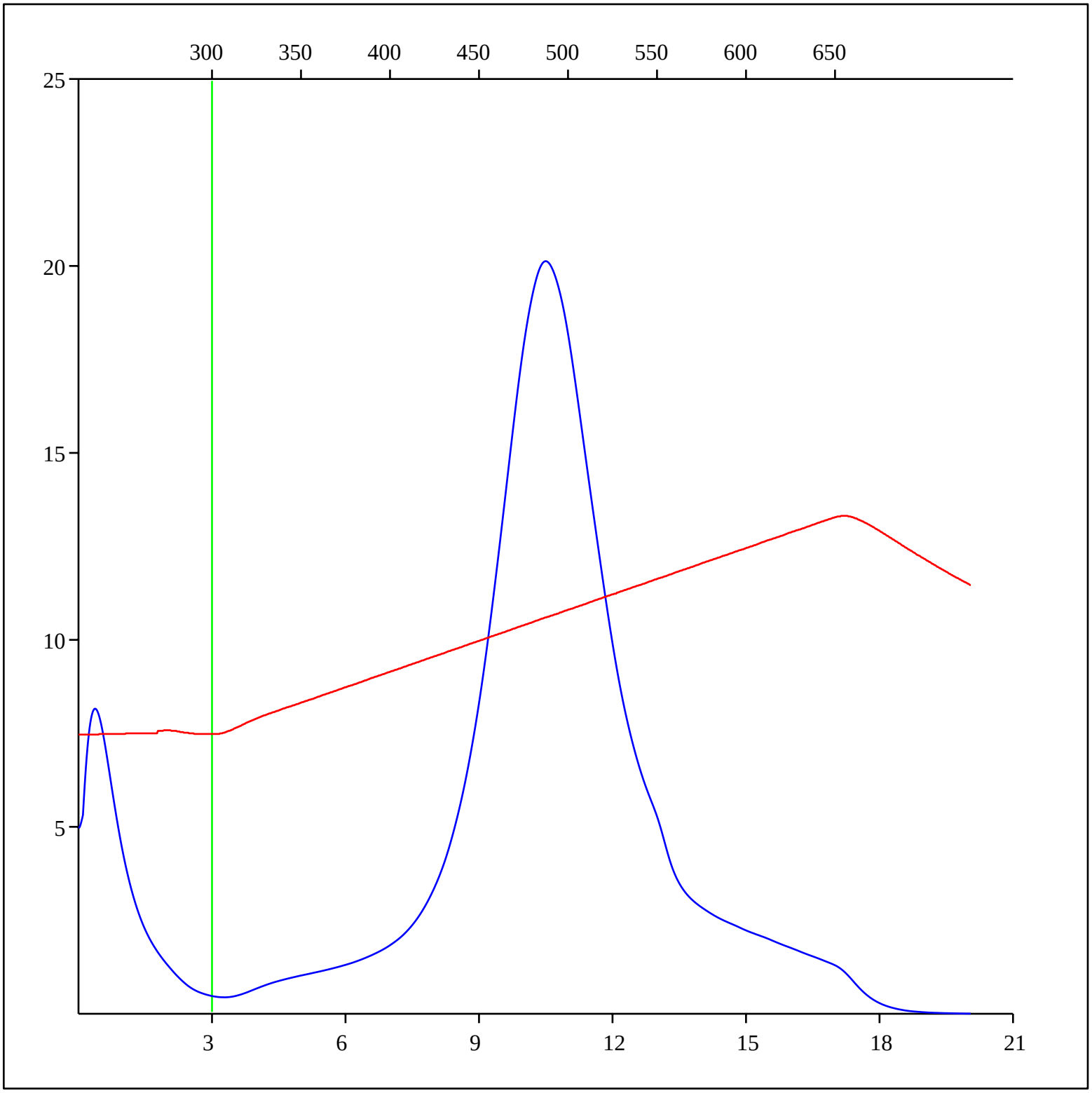
Sample: C-560308
Acquisition Date: 02-AUG-2013
Location: KUGPIK L-24
Depth: 2012.25 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



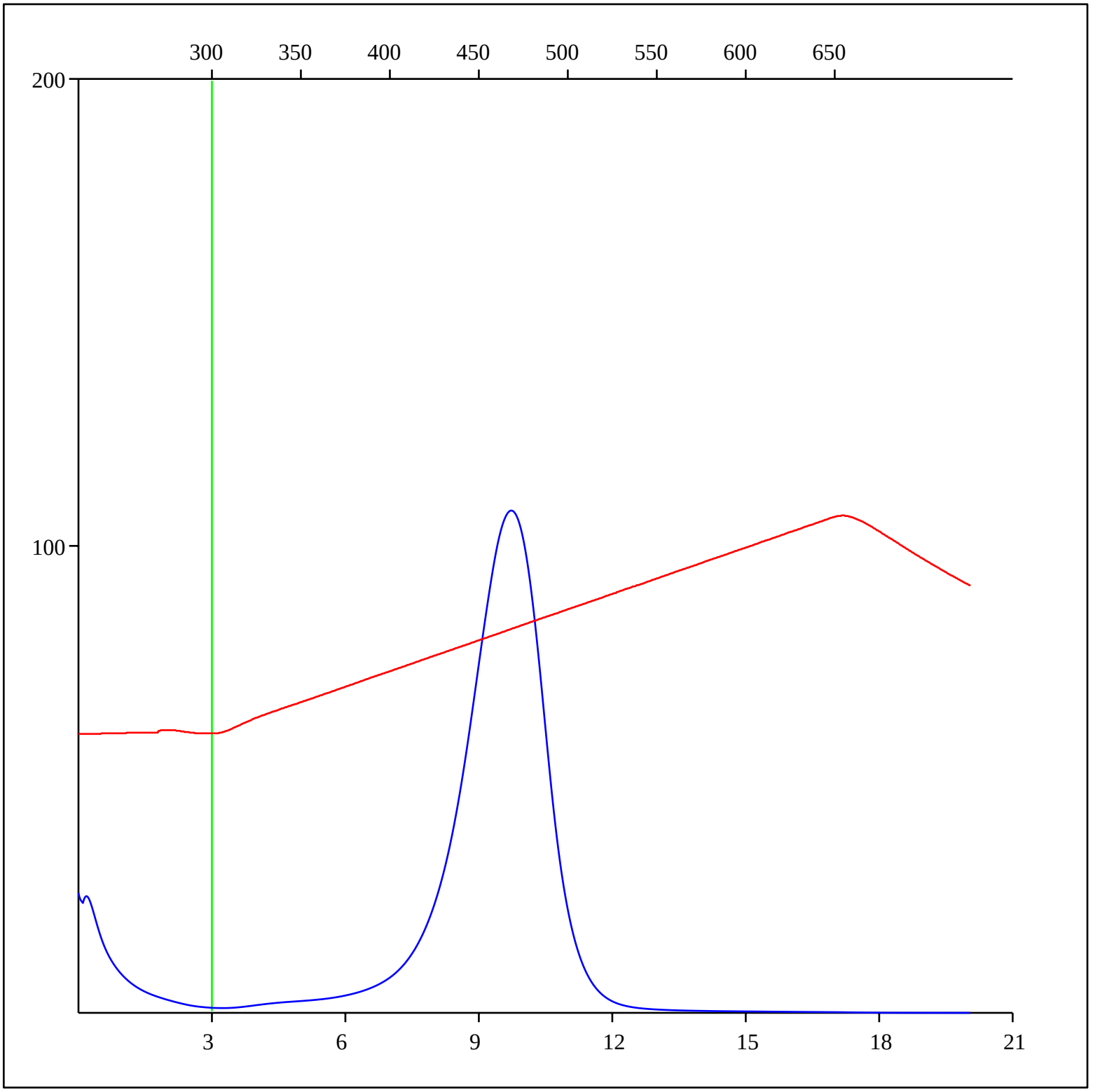
Sample: C-560309
Acquisition Date: 02-AUG-2013
Location: KUGPIK L-24
Depth: 2261.73 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



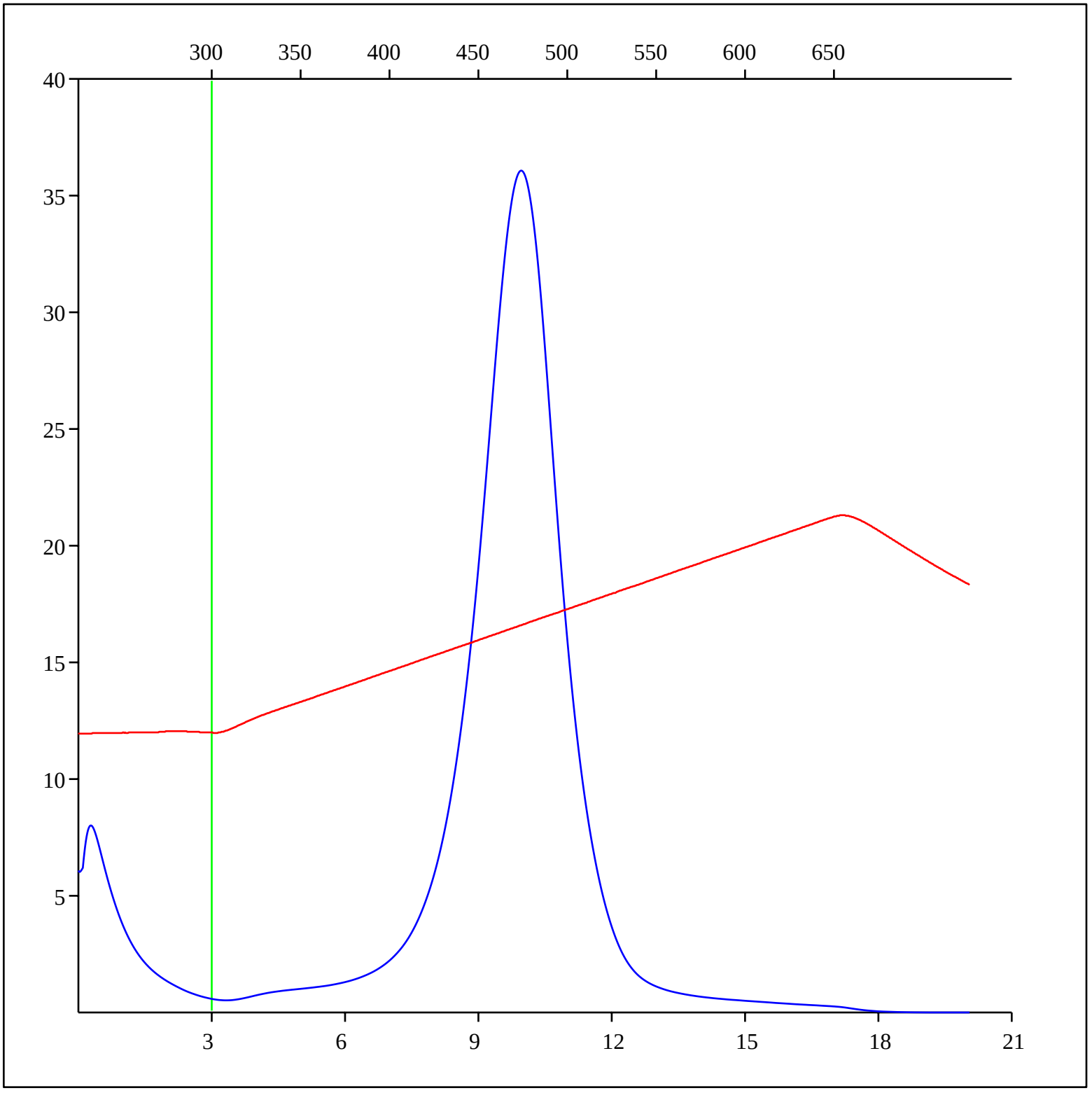
Sample: C-560310
Acquisition Date: 02-AUG-2013
Location: KUGPIK O-13
Depth: 1989.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



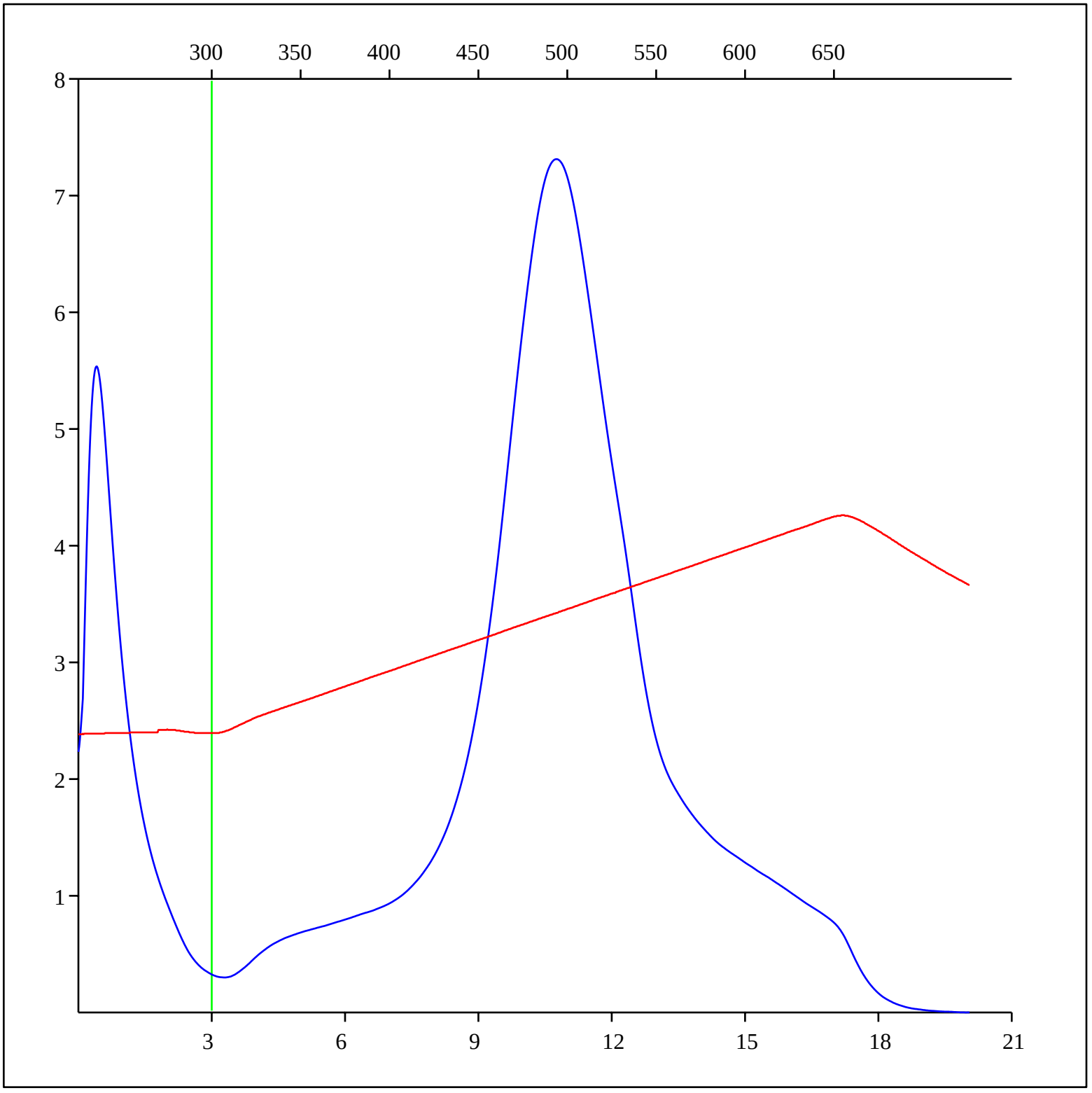
Sample: C-560311
Acquisition Date: 02-AUG-2013
Location: KUGPIK O-13
Depth: 2131 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



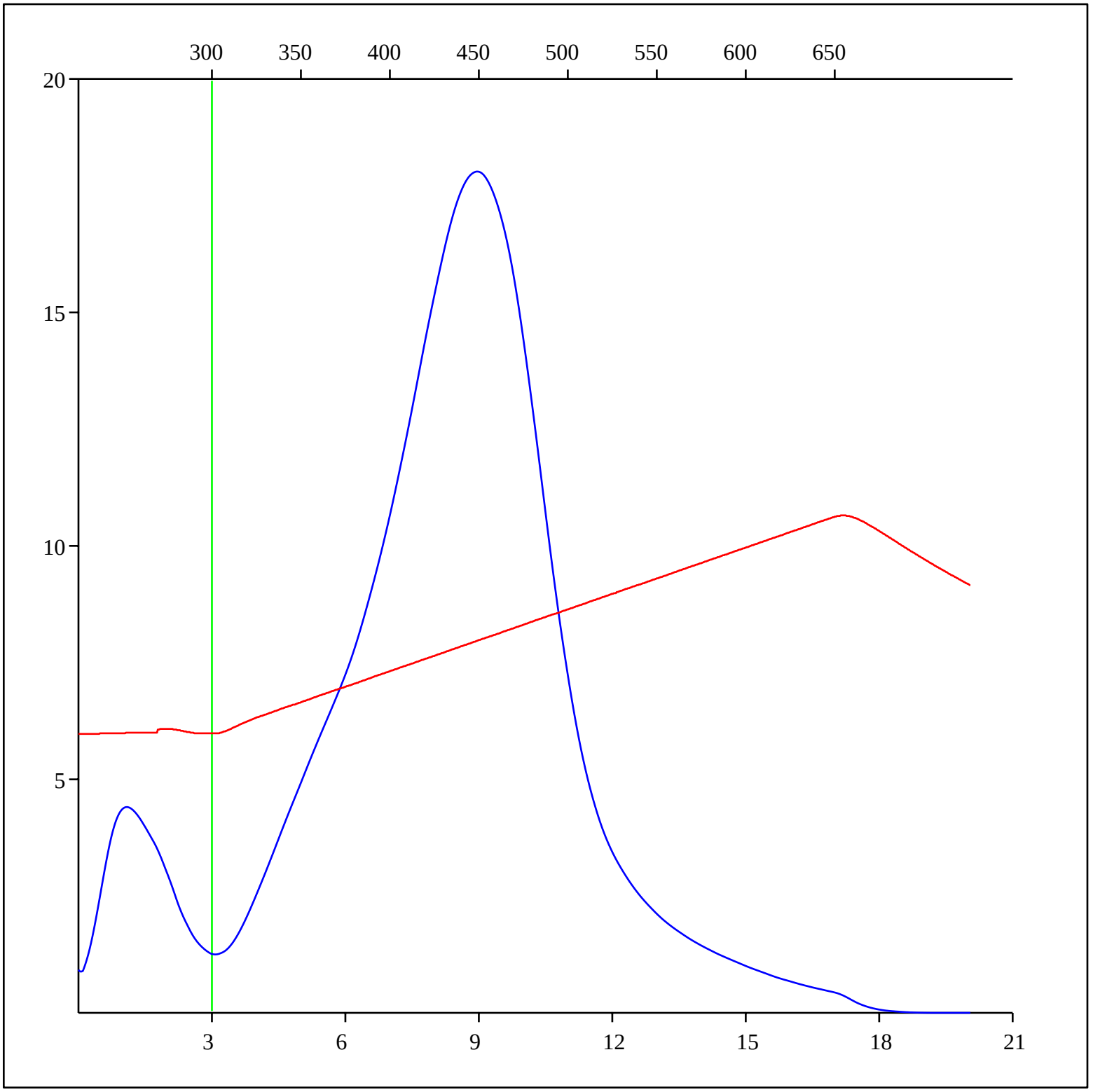
Sample: C-560312
Acquisition Date: 02-AUG-2013
Location: KUGPIK O-13
Depth: 2956.6 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



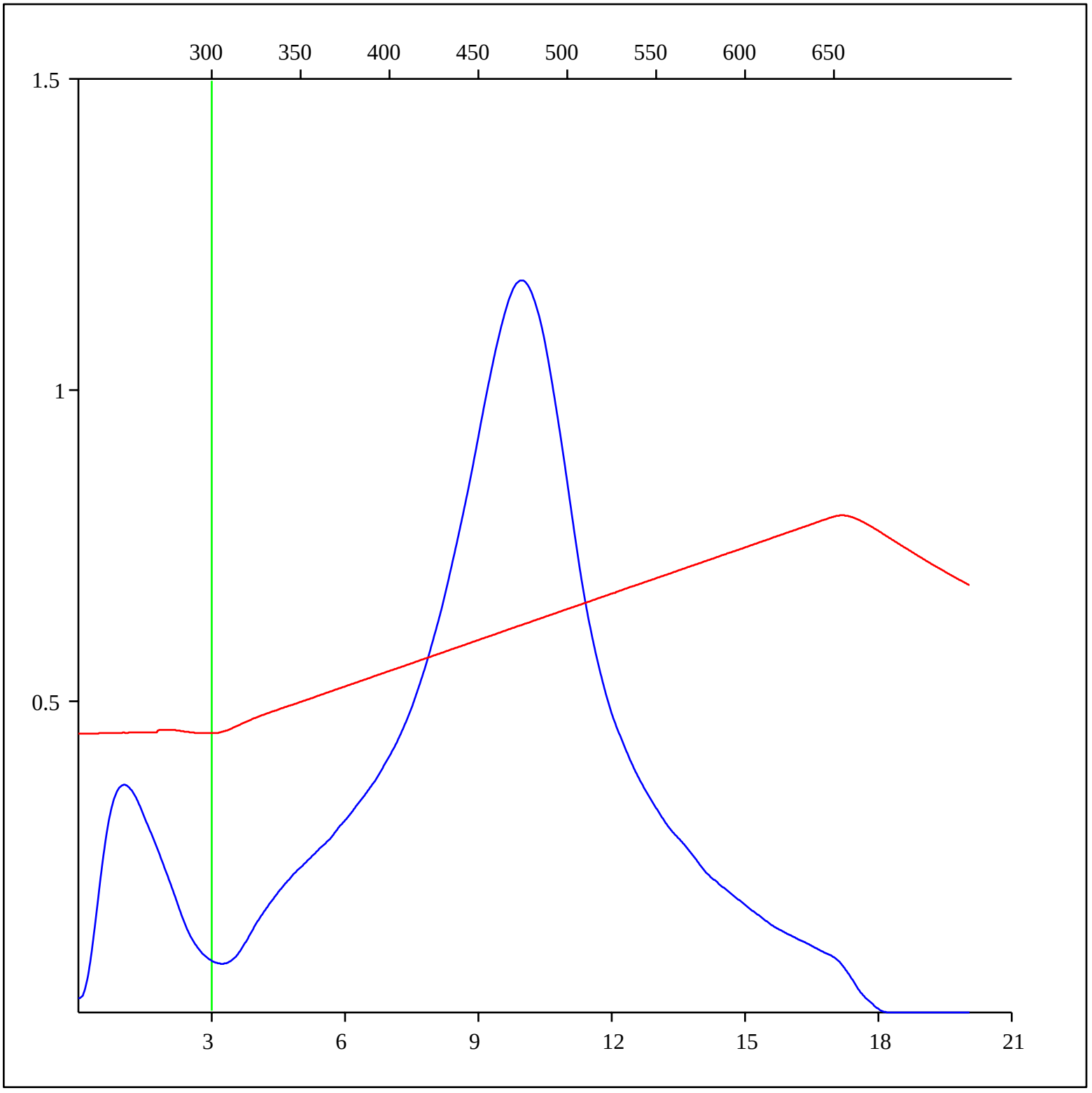
Sample: C-560313
Acquisition Date: 02-AUG-2013
Location: KUMAK E-58
Depth: 1132.55 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



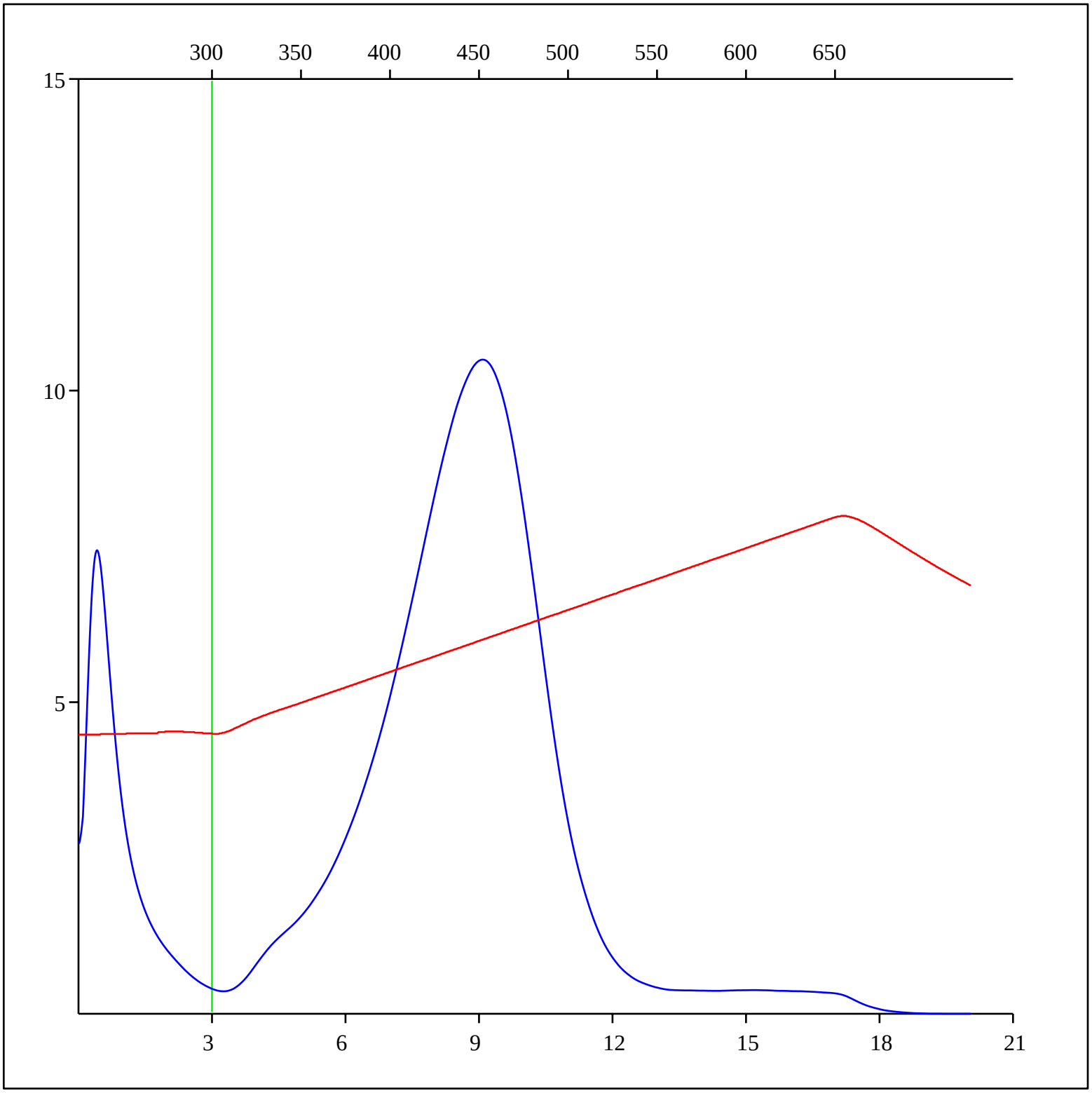
Sample: C-560314
Acquisition Date: 02-AUG-2013
Location: KUMAK E-58
Depth: 1137.8 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



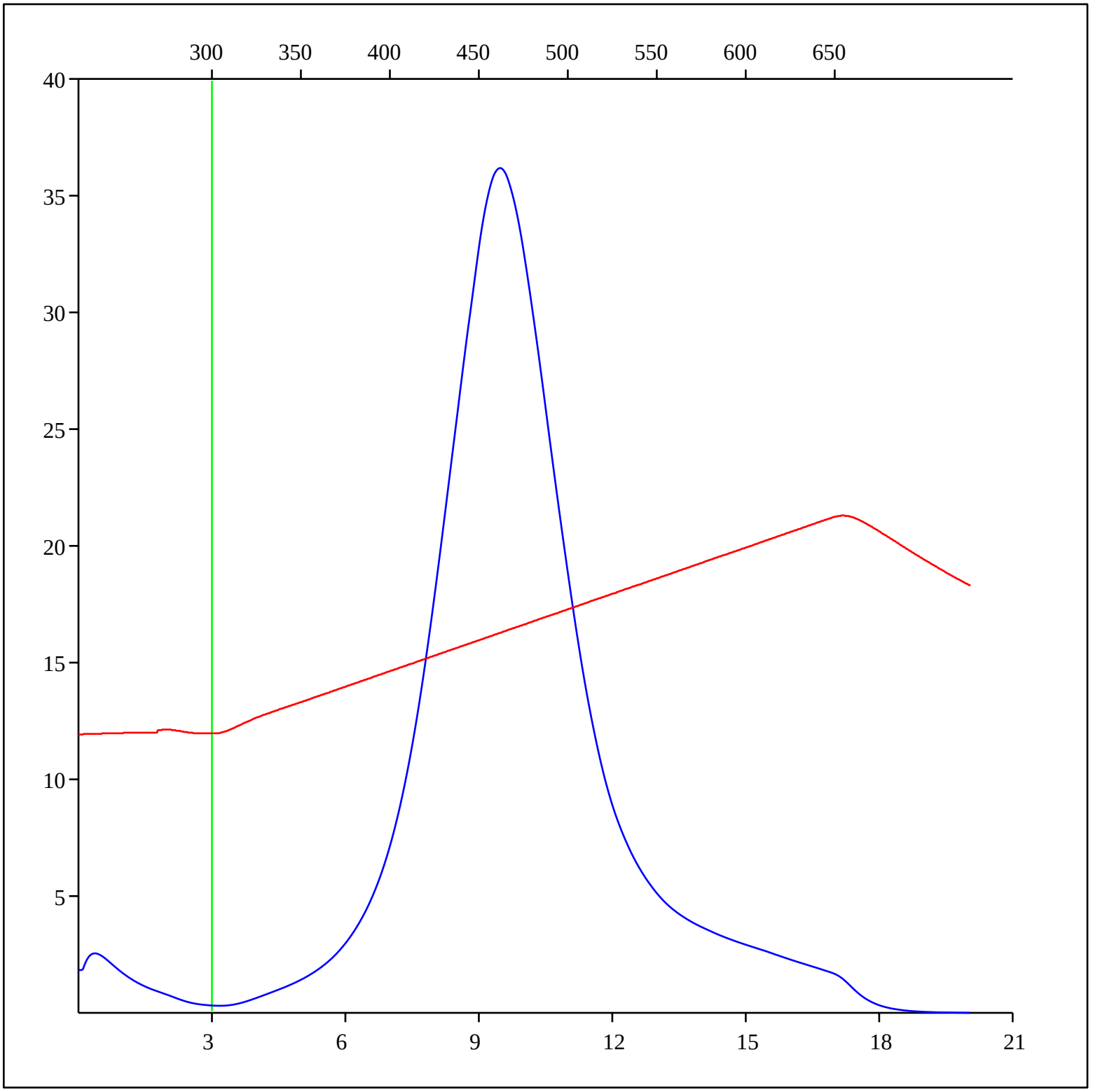
Sample: C-560315
Acquisition Date: 02-AUG-2013
Location: KUMAK J-06
Depth: 1368.9 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



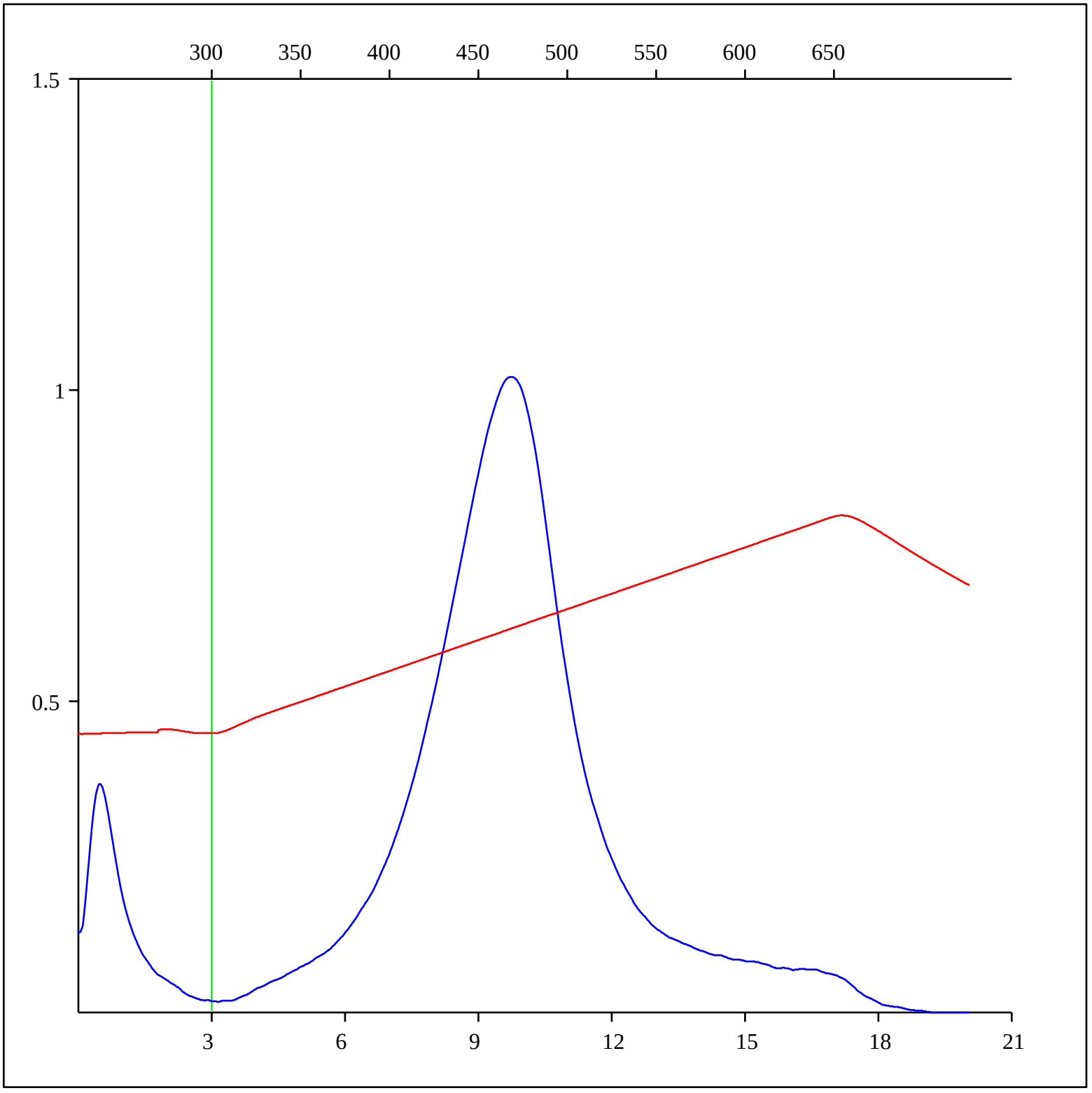
Sample: C-560316
Acquisition Date: 02-AUG-2013
Location: KUMAK J-06
Depth: 2308.12 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



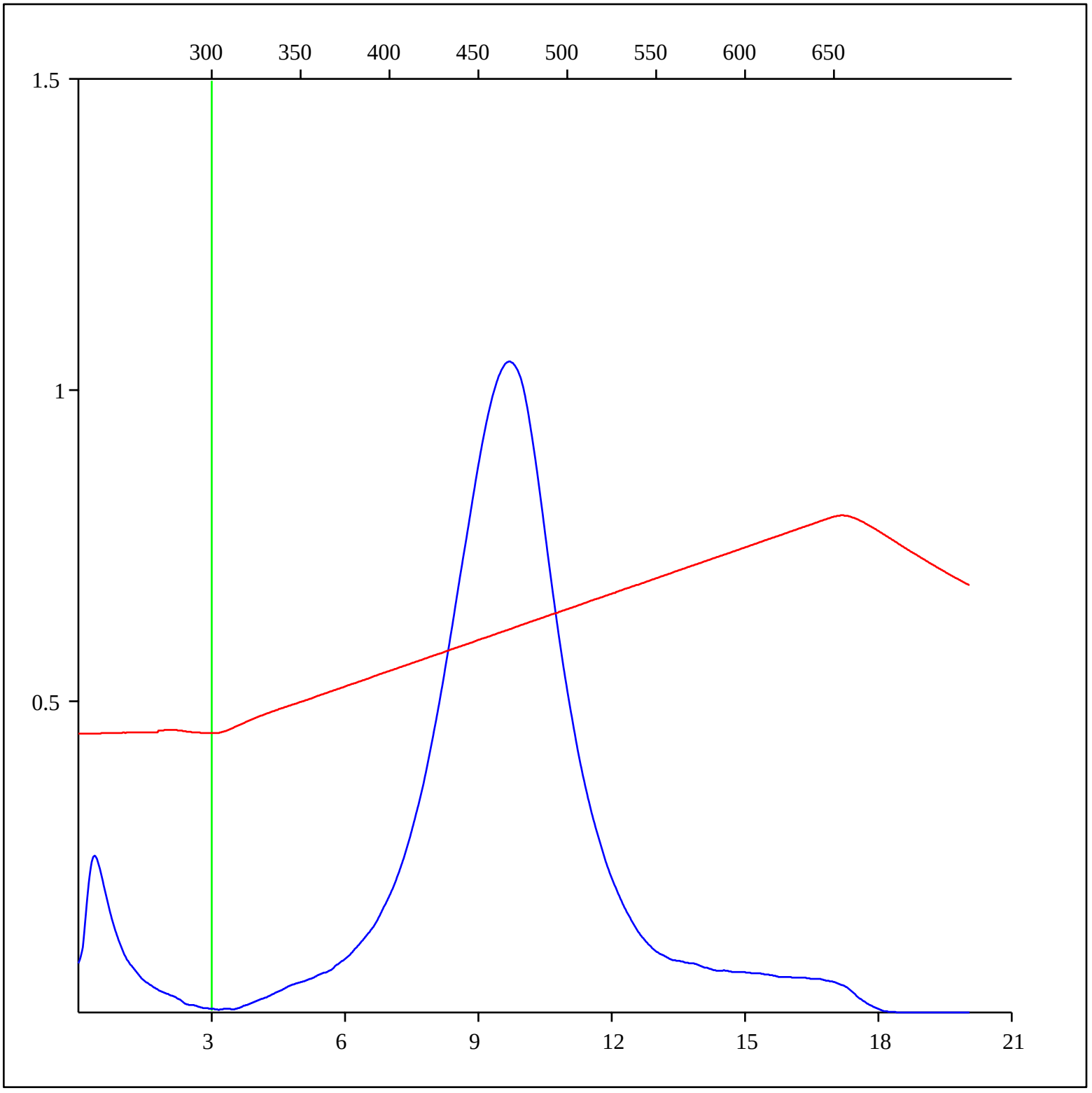
Sample: C-560317
Acquisition Date: 02-AUG-2013
Location: MALLIK A-06
Depth: 2641.9 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



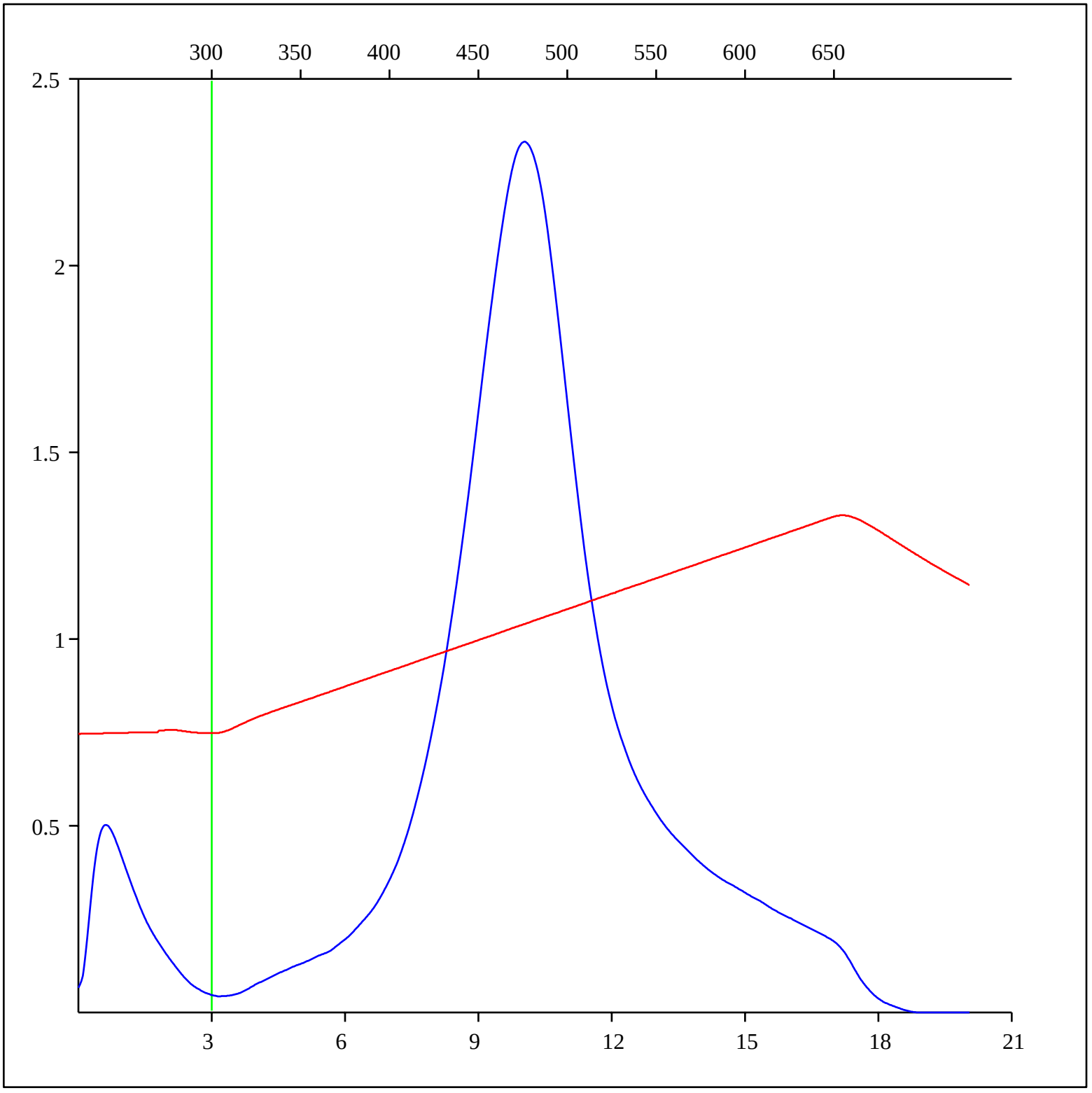
Sample: C-560318
Acquisition Date: 02-AUG-2013
Location: MALLIK A-06
Depth: 2826.28 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



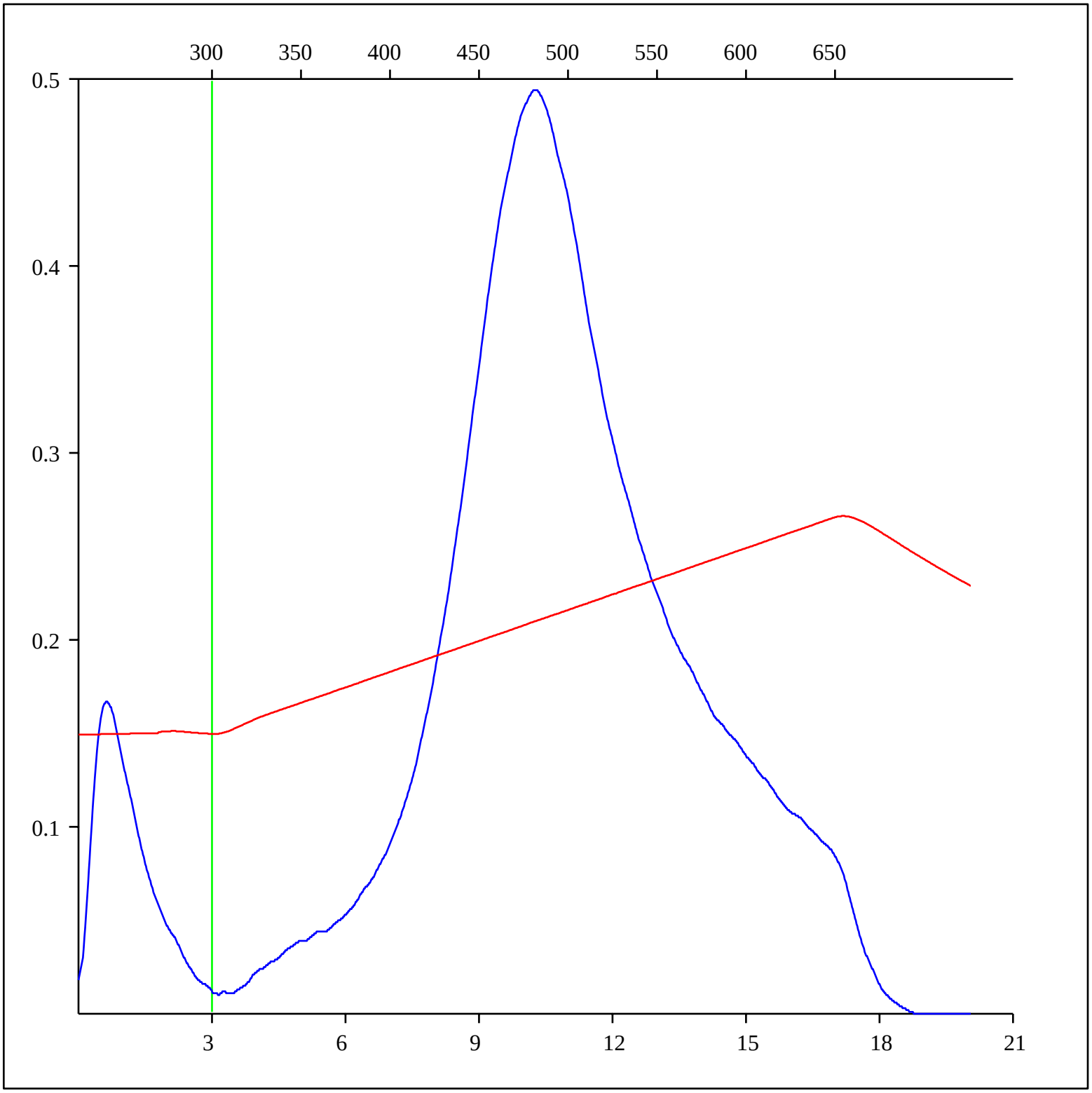
Sample: C-560319
Acquisition Date: 02-AUG-2013
Location: MALLIK A-06
Depth: 2943.8 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



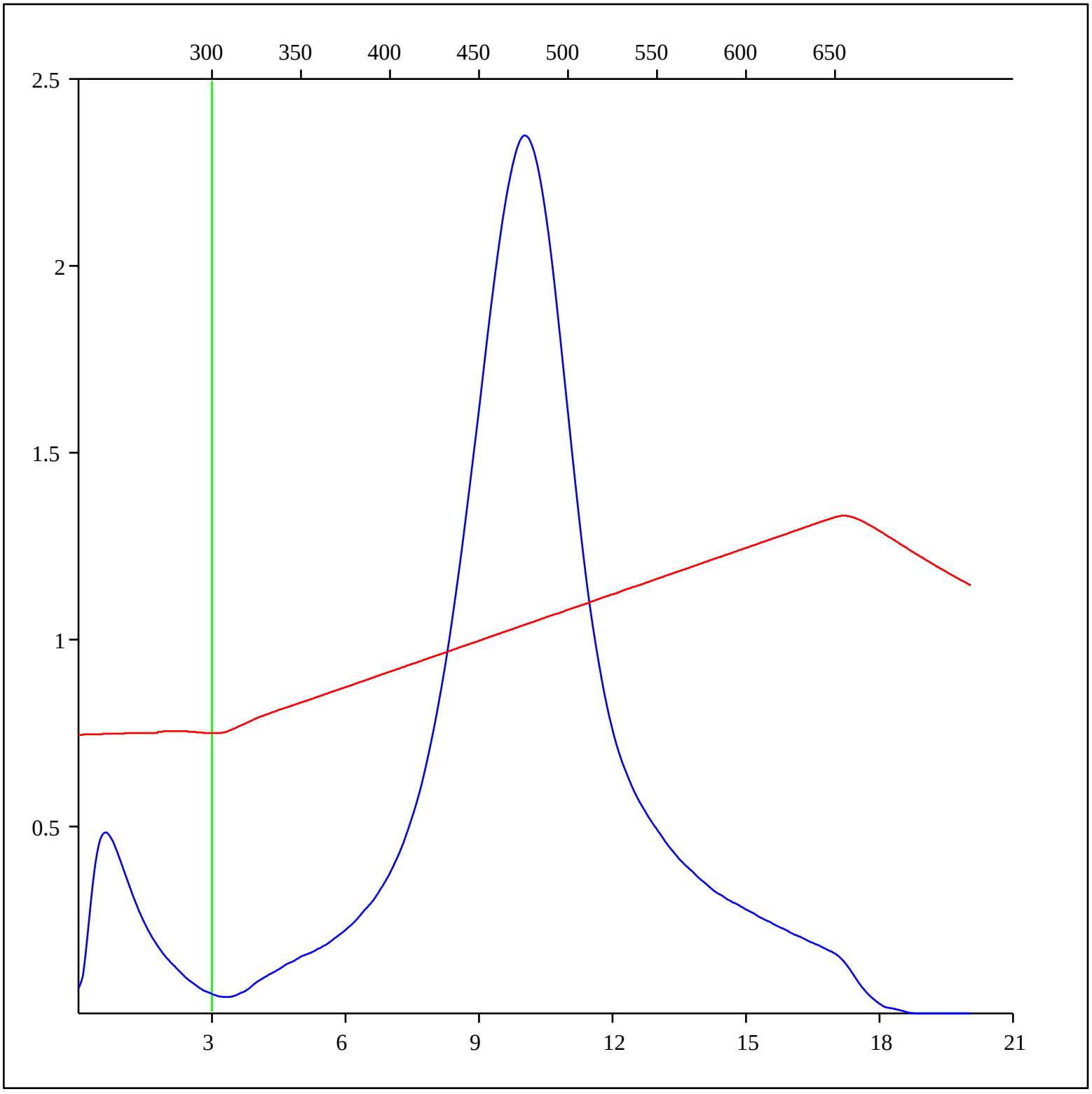
Sample: C-560320
Acquisition Date: 02-AUG-2013
Location: MALLIK A-06
Depth: 3218.6 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



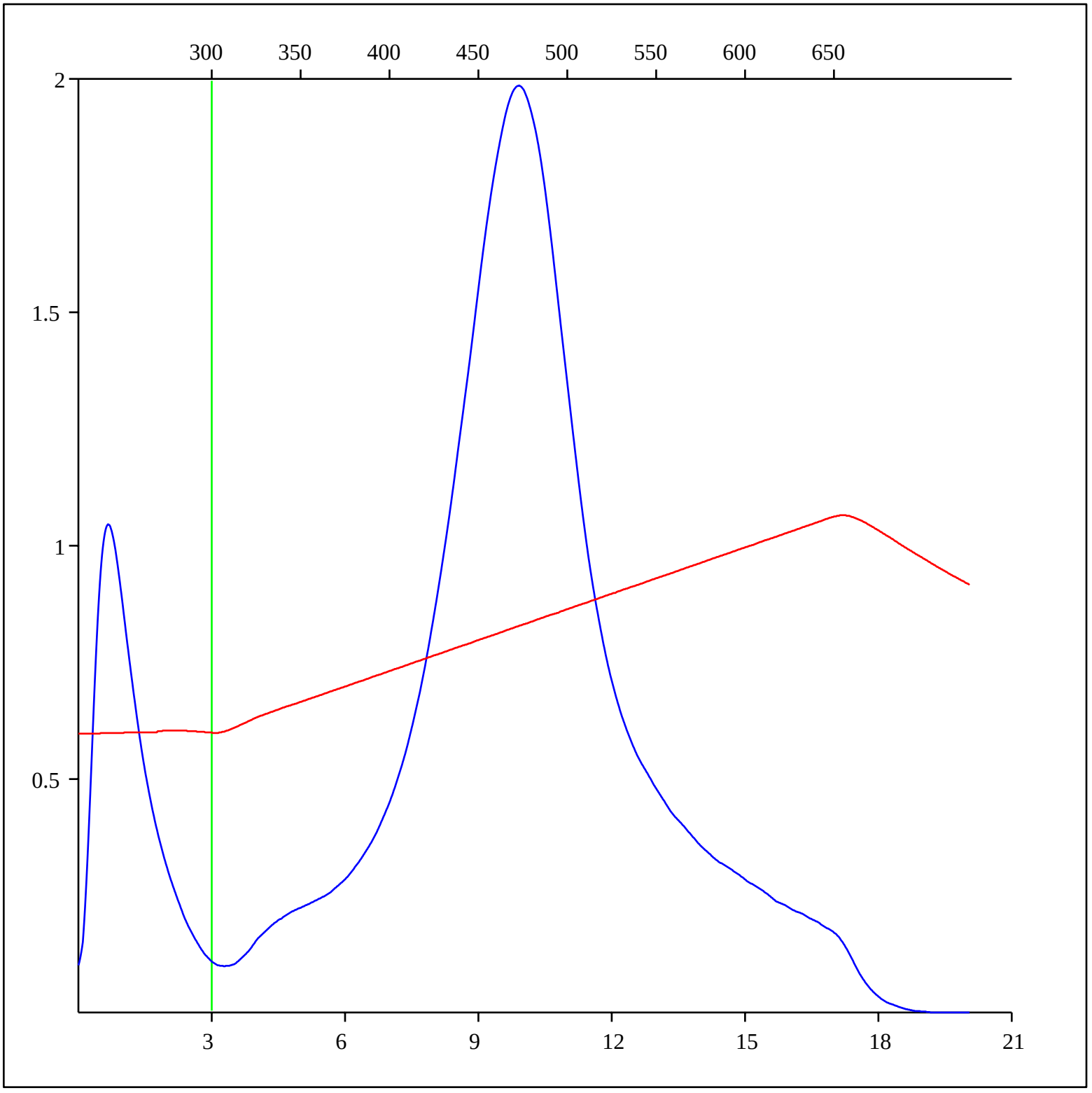
Sample: C-560321
Acquisition Date: 02-AUG-2013
Location: MALLIK A-06
Depth: 3602.28 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



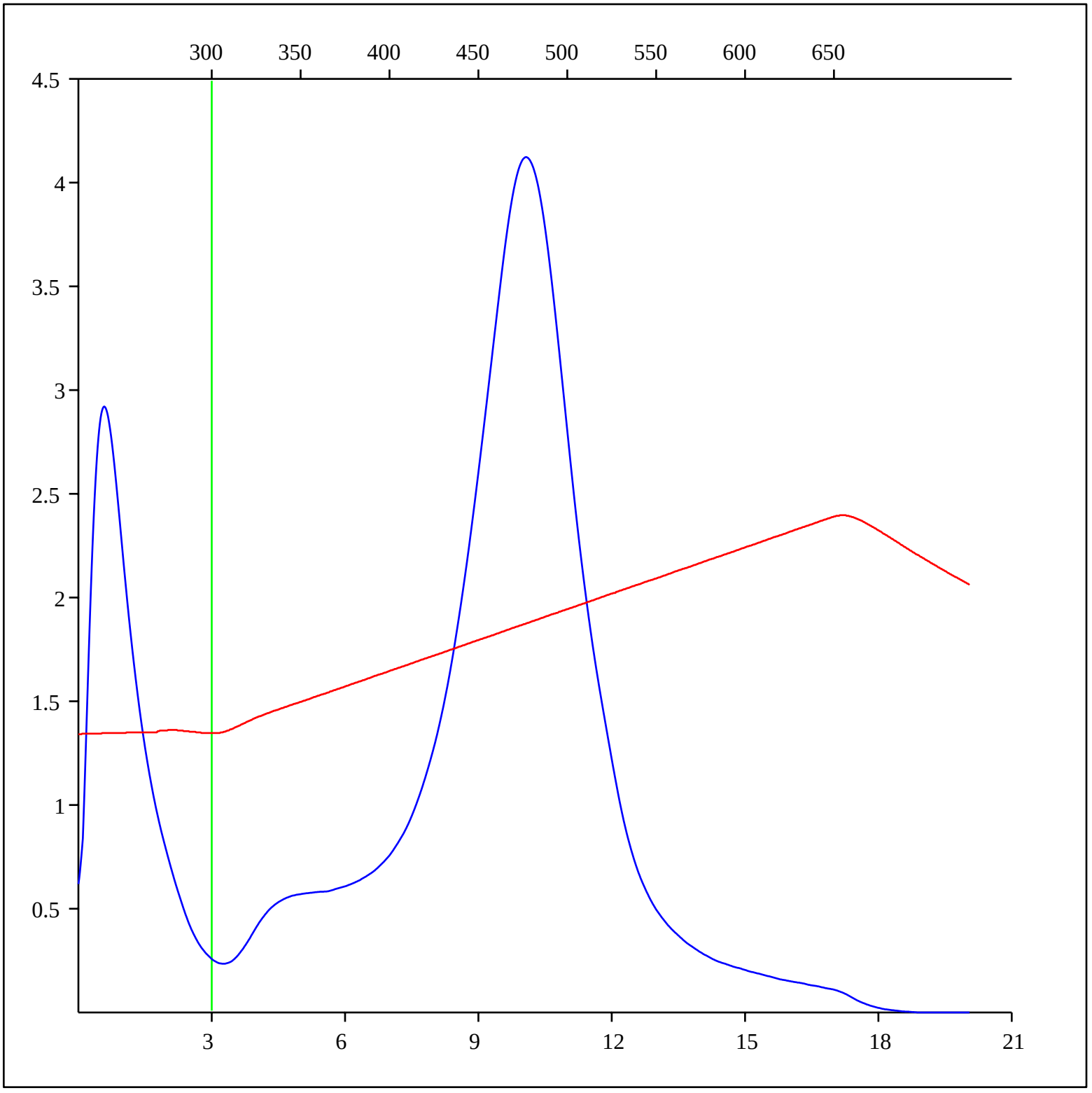
Sample: C-560322
Acquisition Date: 02-AUG-2013
Location: MAYOGIAK J-17
Depth: 2181.4 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



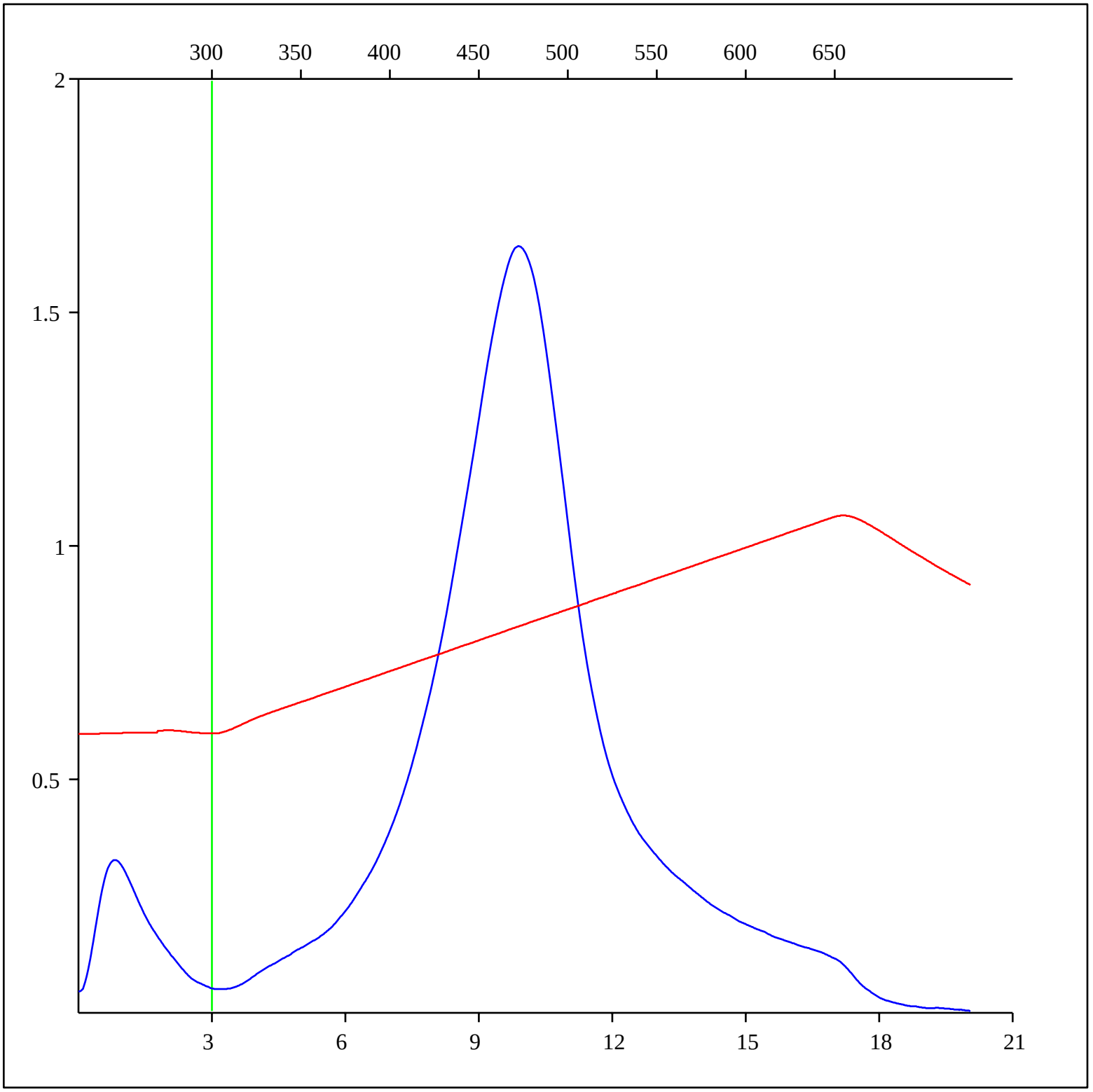
Sample: C-560323
Acquisition Date: 02-AUG-2013
Location: MAYOGIAK J-17
Depth: 2699.9 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



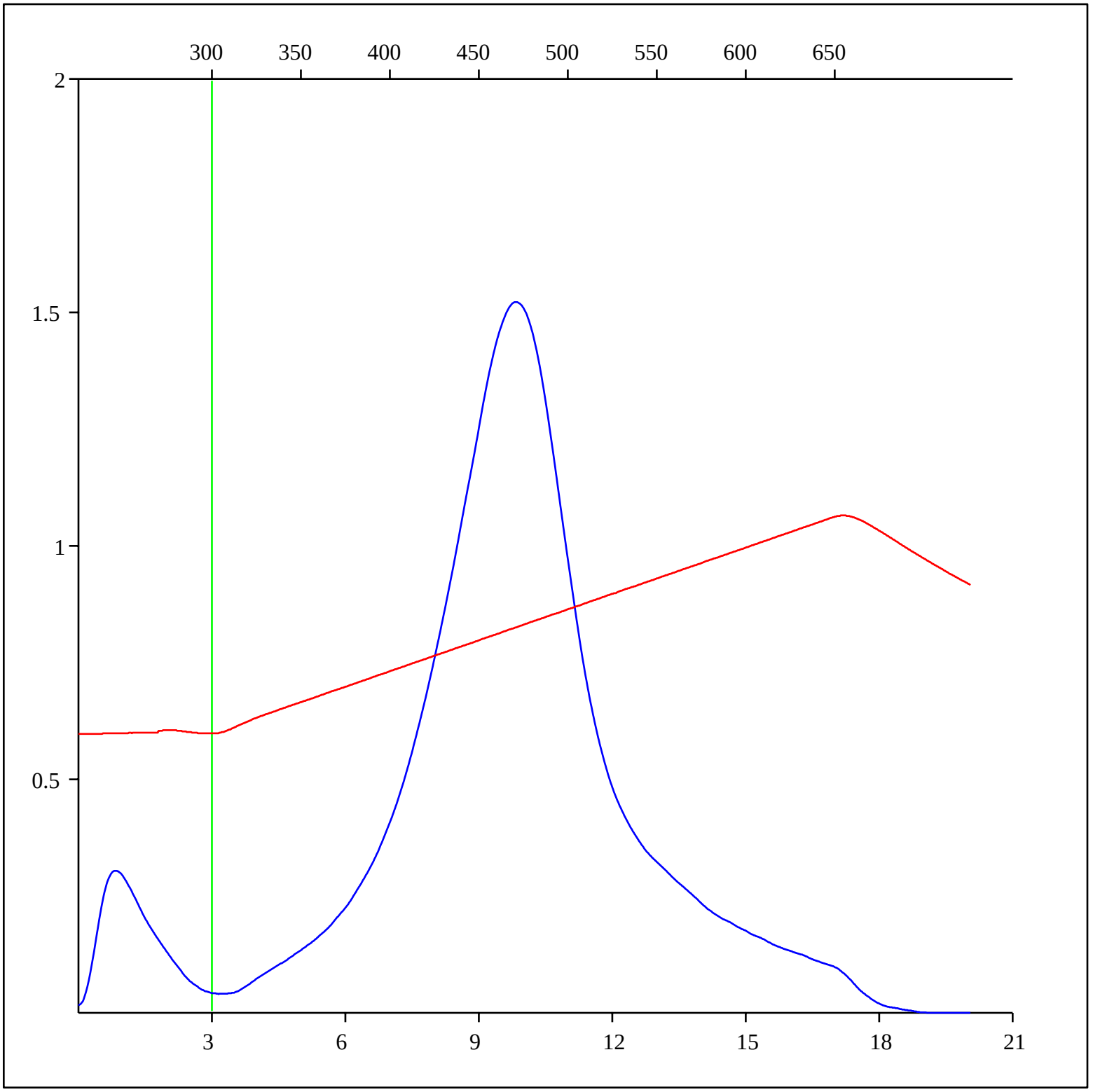
Sample: C-560324
Acquisition Date: 02-AUG-2013
Location: NERLERK J-67
Depth: 3959.85 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



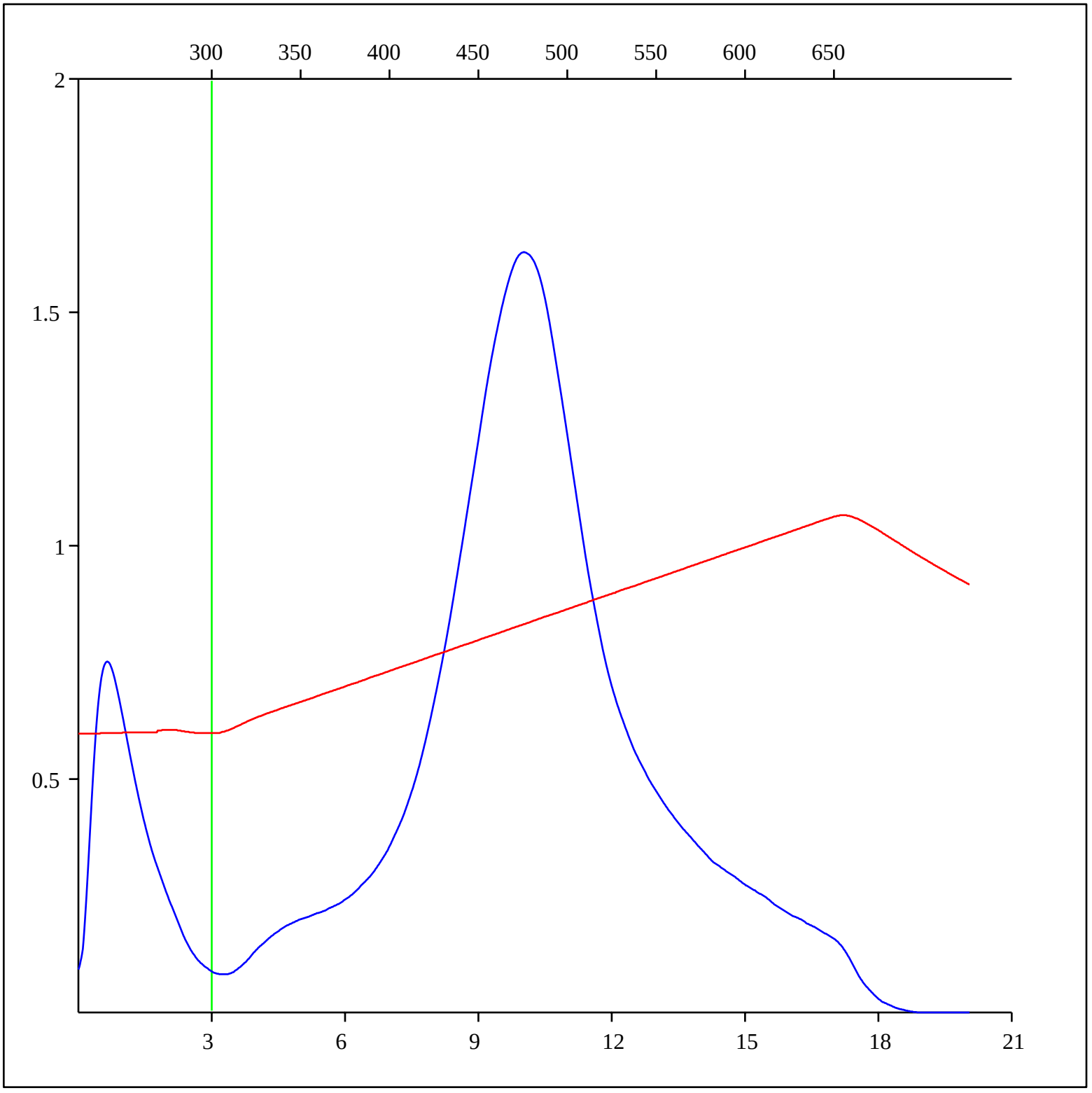
Sample: C-560325
Acquisition Date: 02-AUG-2013
Location: NERLERK J-67
Depth: 4355.3 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



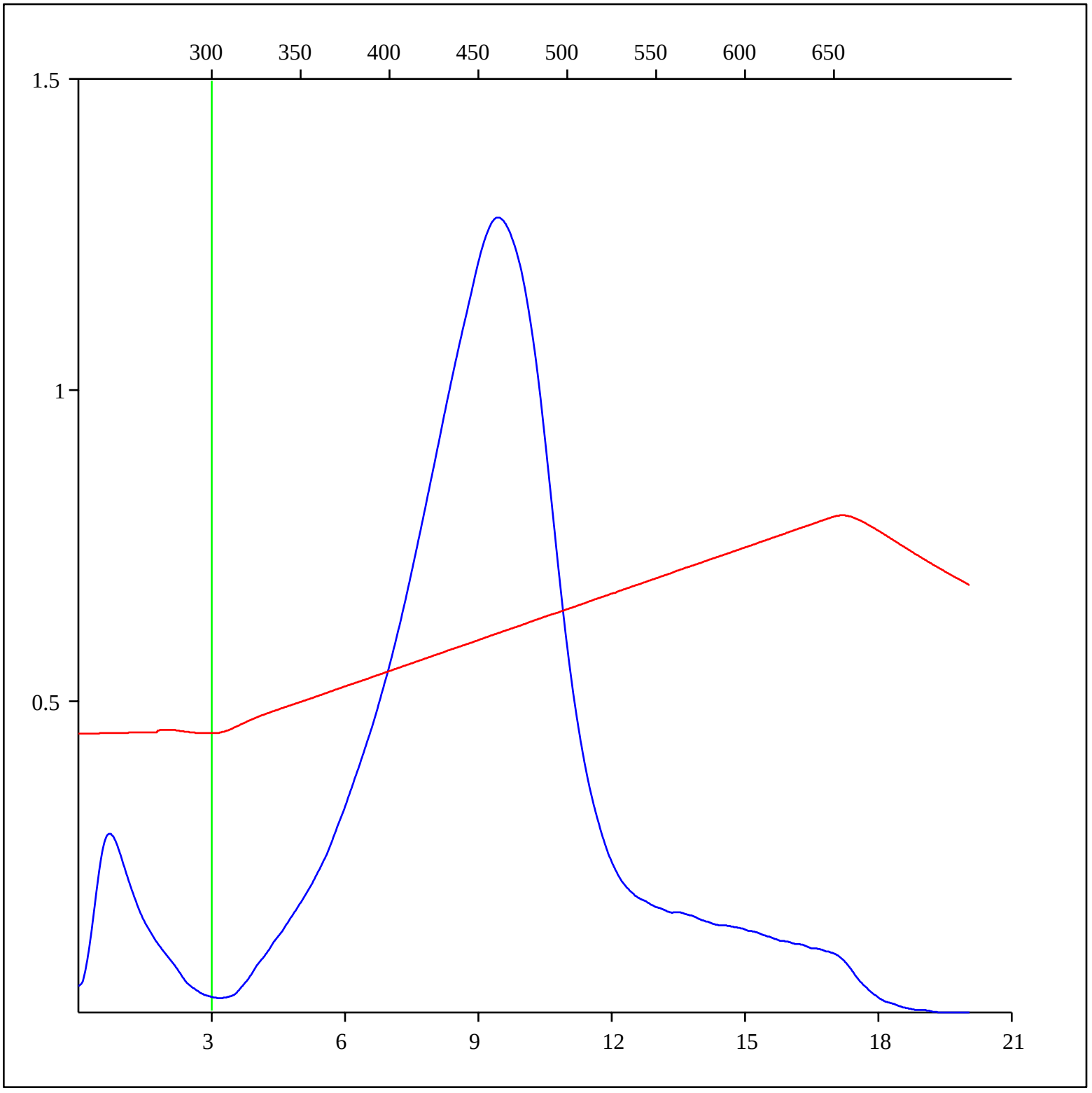
Sample: C-560326
Acquisition Date: 02-AUG-2013
Location: NETSERK B-44
Depth: 3303.05 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



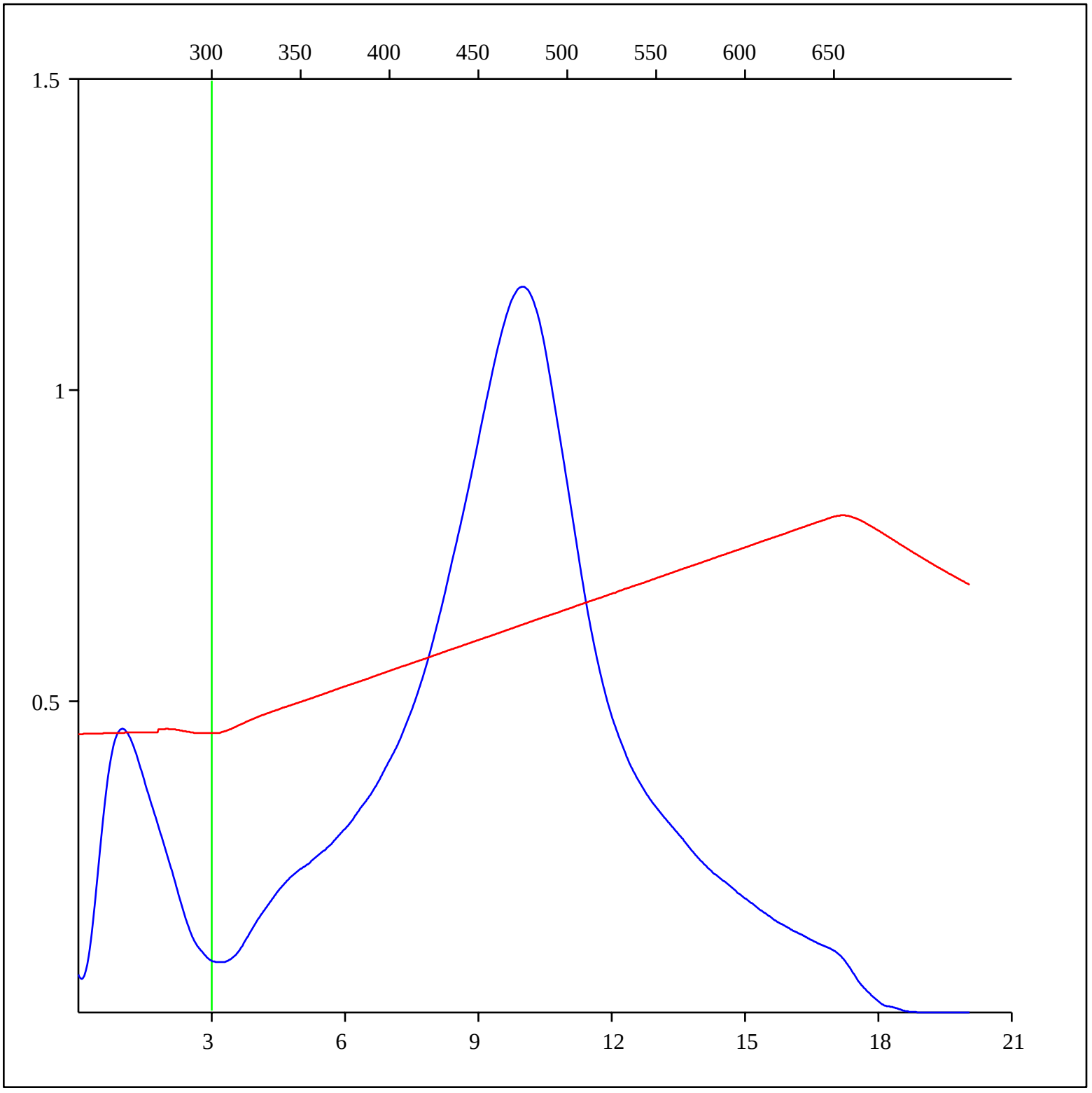
Sample: C-560327
Acquisition Date: 02-AUG-2013
Location: NETSERK F-40
Depth: 1859.45 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



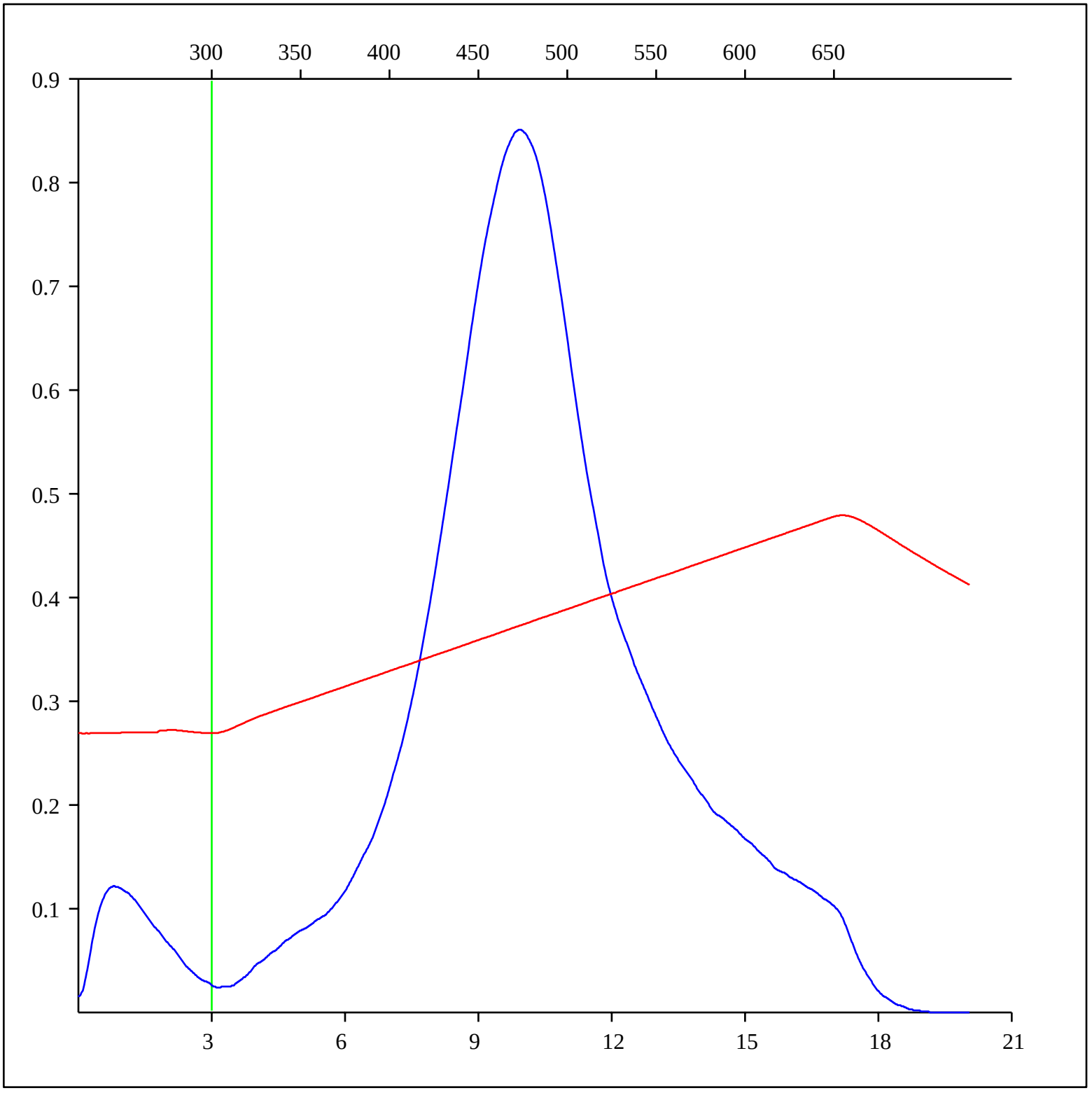
Sample: C-560328
Acquisition Date: 02-AUG-2013
Location: NIGLINTGAK B-19
Depth: 895.25 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



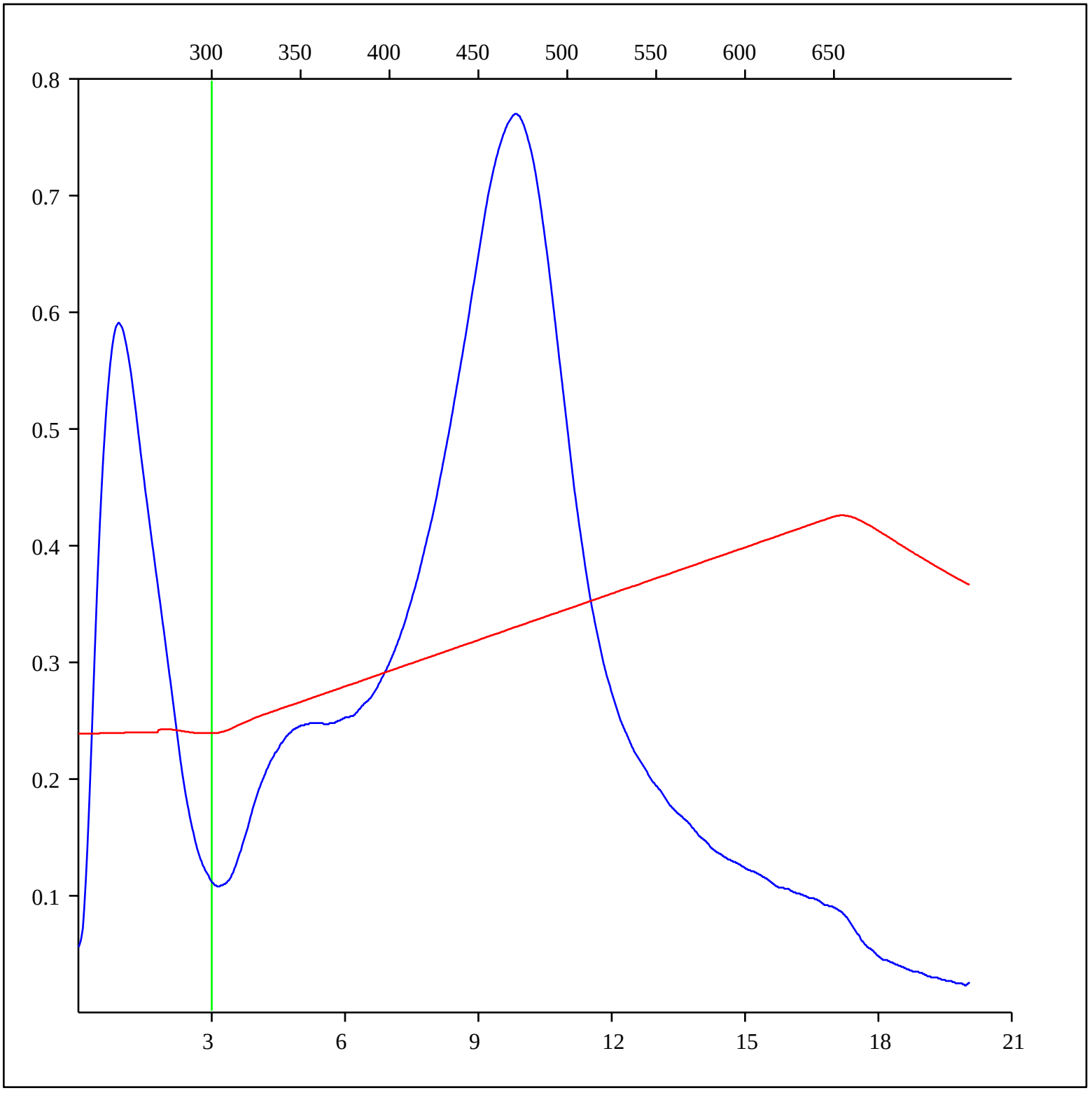
Sample: C-560329
Acquisition Date: 02-AUG-2013
Location: NIGLINTGAK B-19
Depth: 1950.46 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



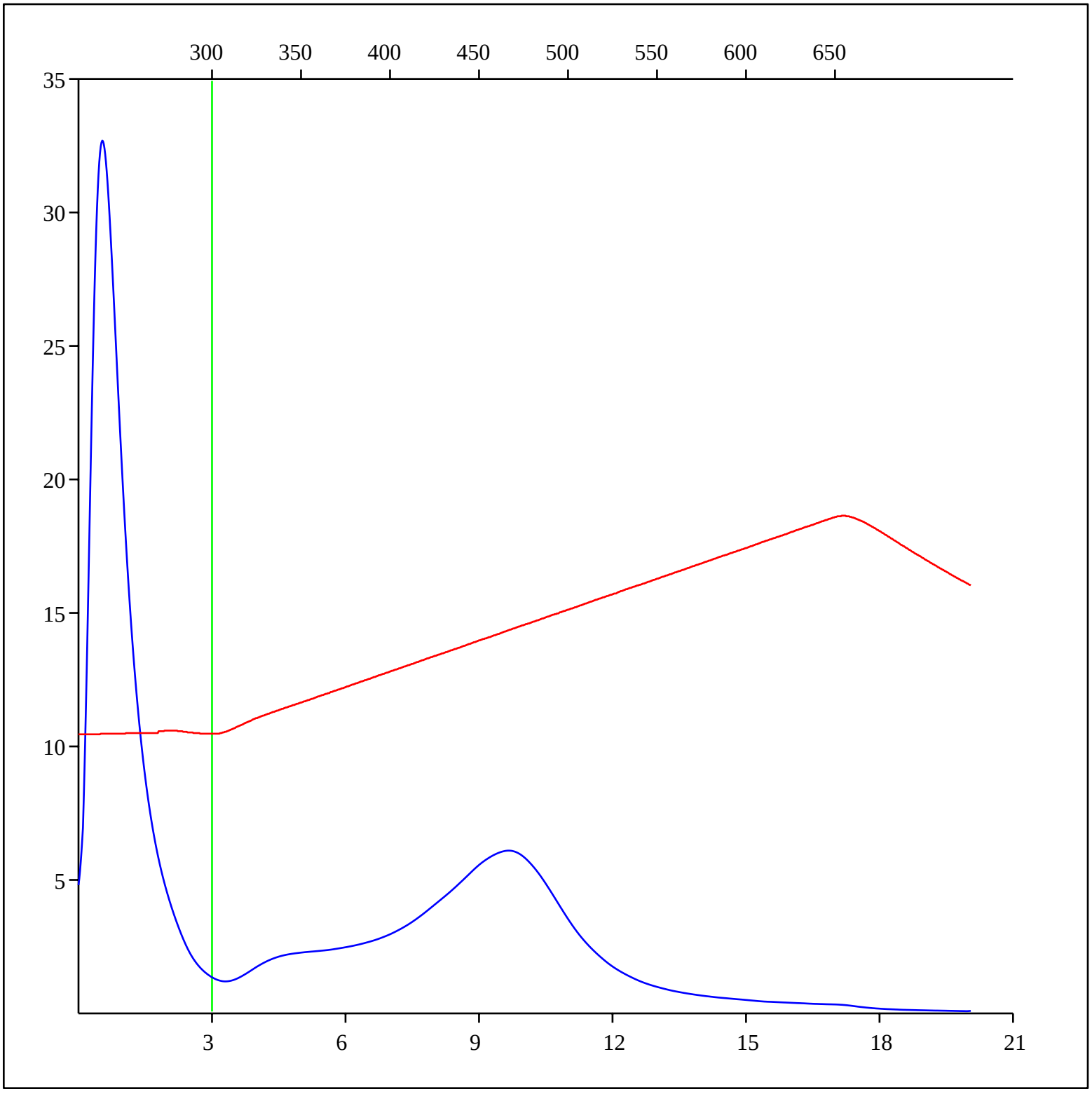
Sample: C-560330
Acquisition Date: 02-AUG-2013
Location: NIGLINTGAK M-19
Depth: 976.6 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



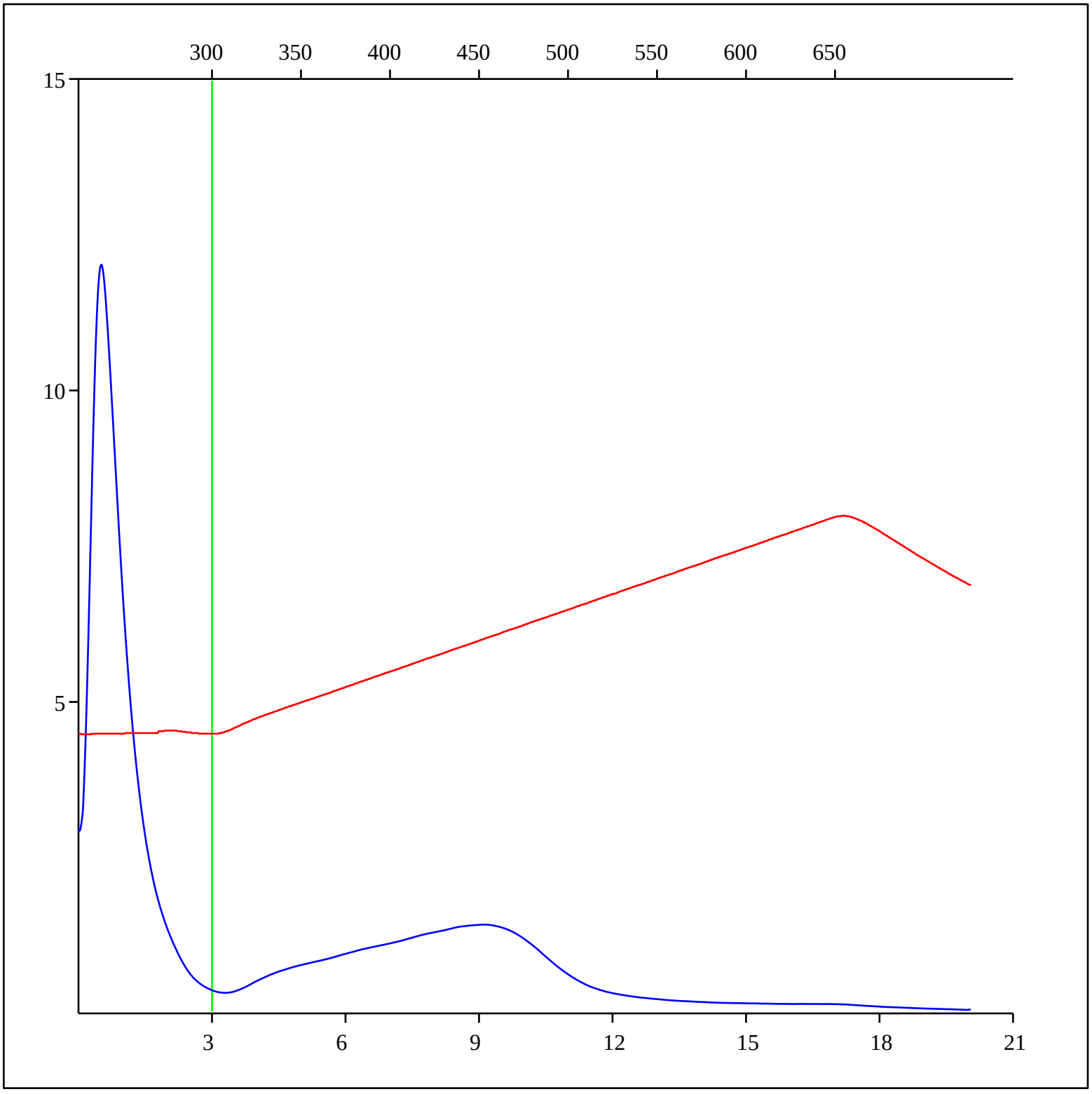
Sample: C-560331
Acquisition Date: 02-AUG-2013
Location: NIGLINTGAK M-19
Depth: 1296.7 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



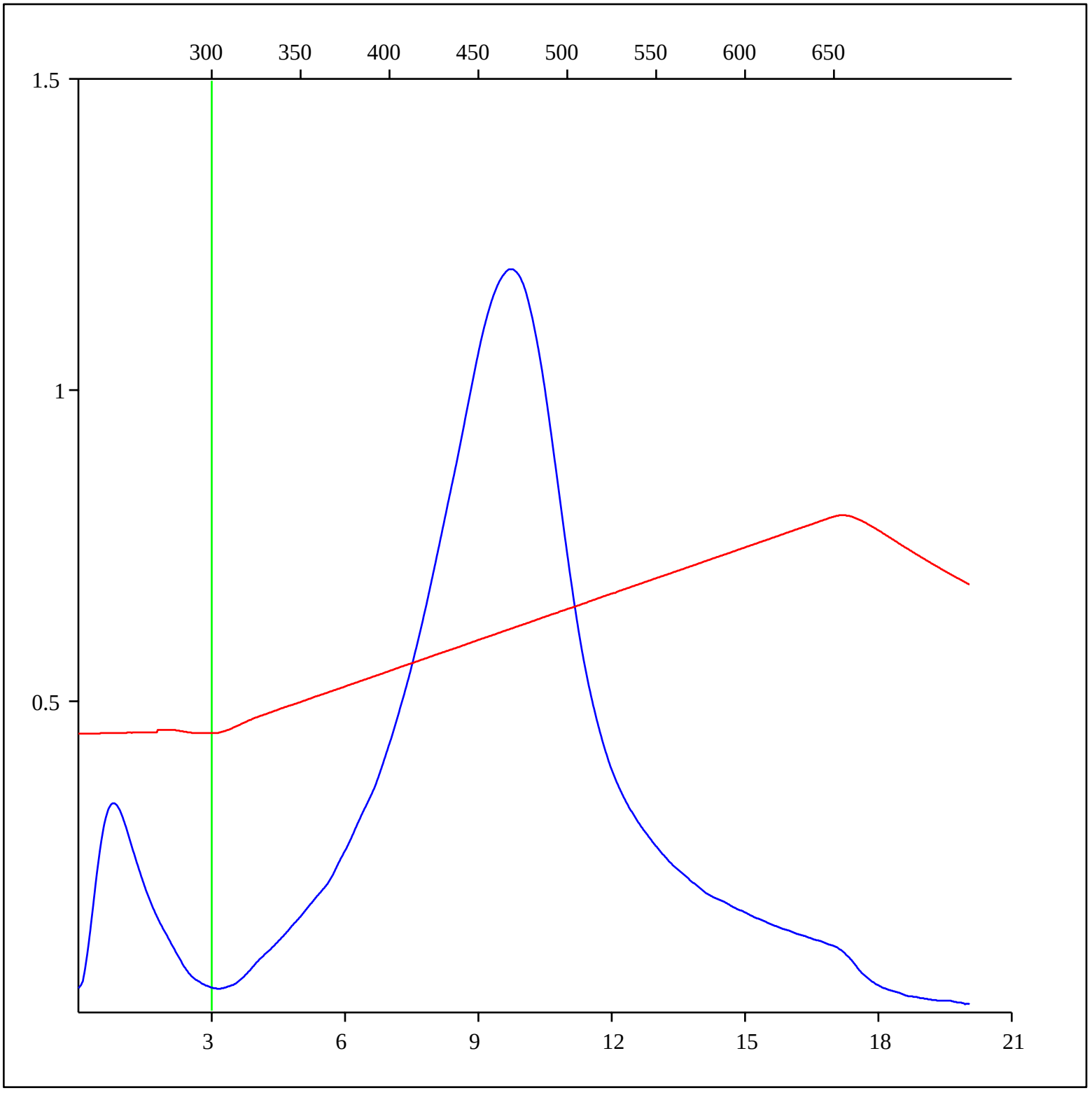
Sample: C-560332
Acquisition Date: 02-AUG-2013
Location: NIPTERK L-19
Depth: 1321.2 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



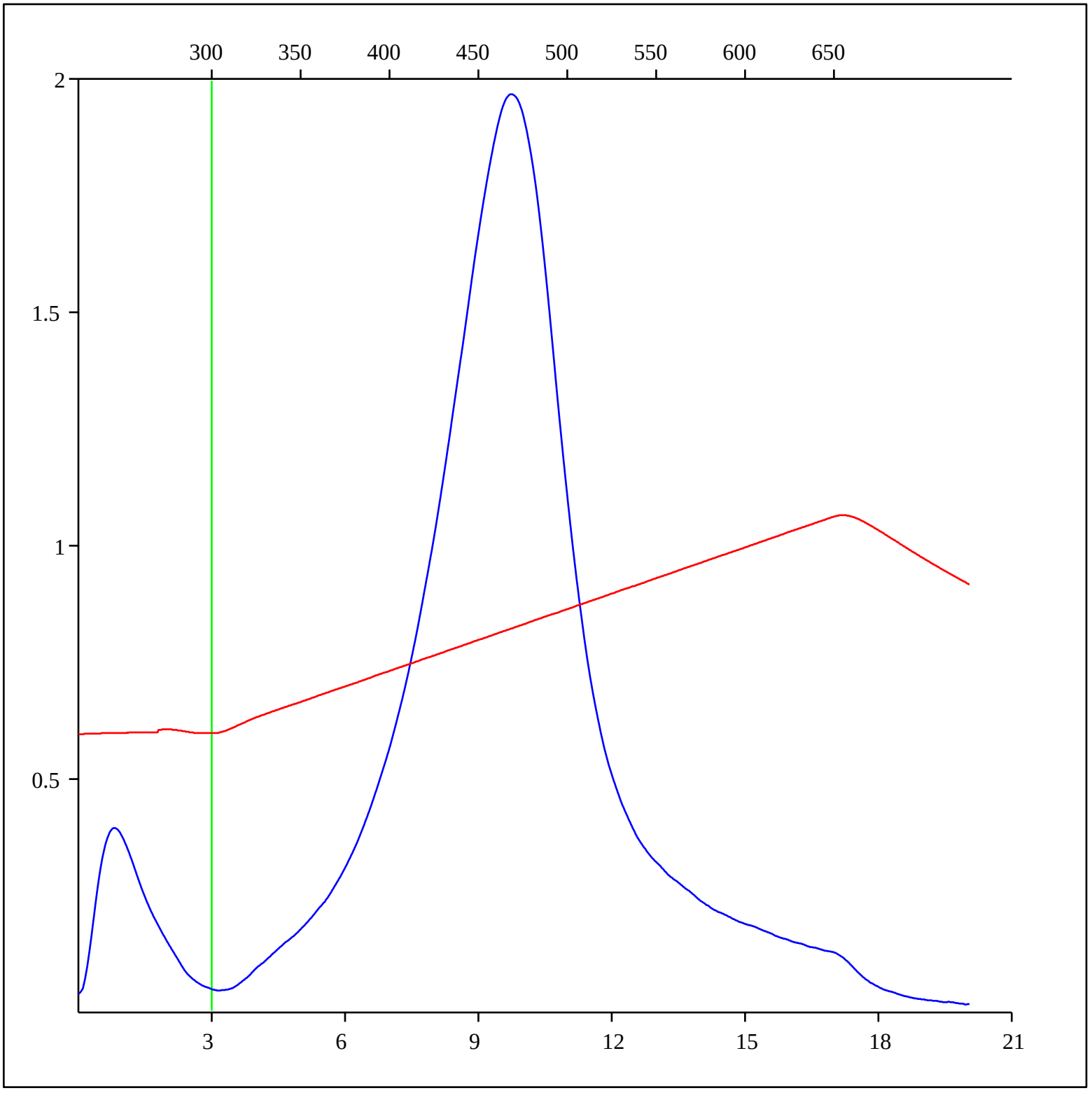
Sample: C-560333
Acquisition Date: 02-AUG-2013
Location: NIPTERK L-19
Depth: 1933 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



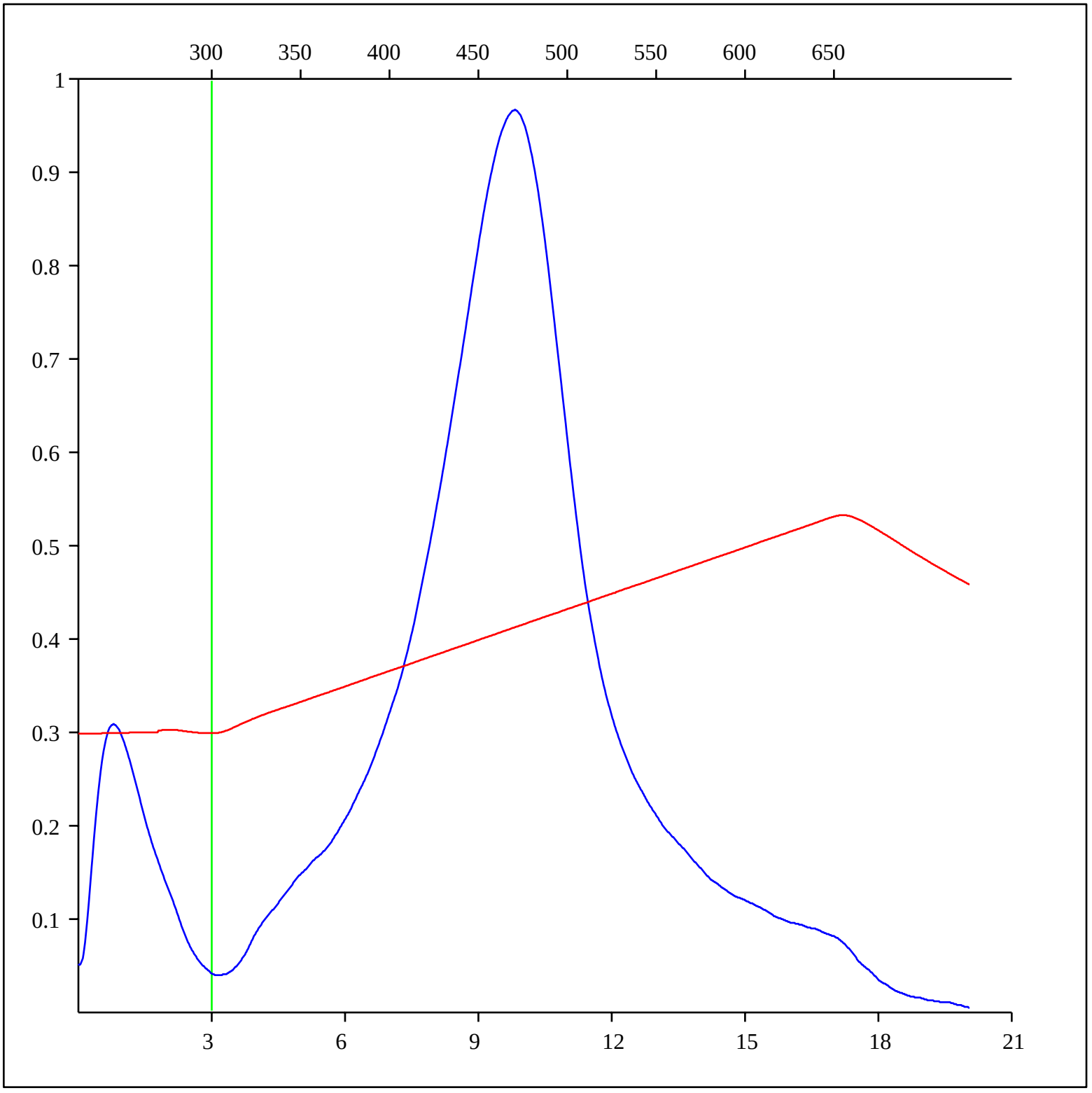
Sample: C-560334
Acquisition Date: 02-AUG-2013
Location: NIPTERK L-19
Depth: 2102.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



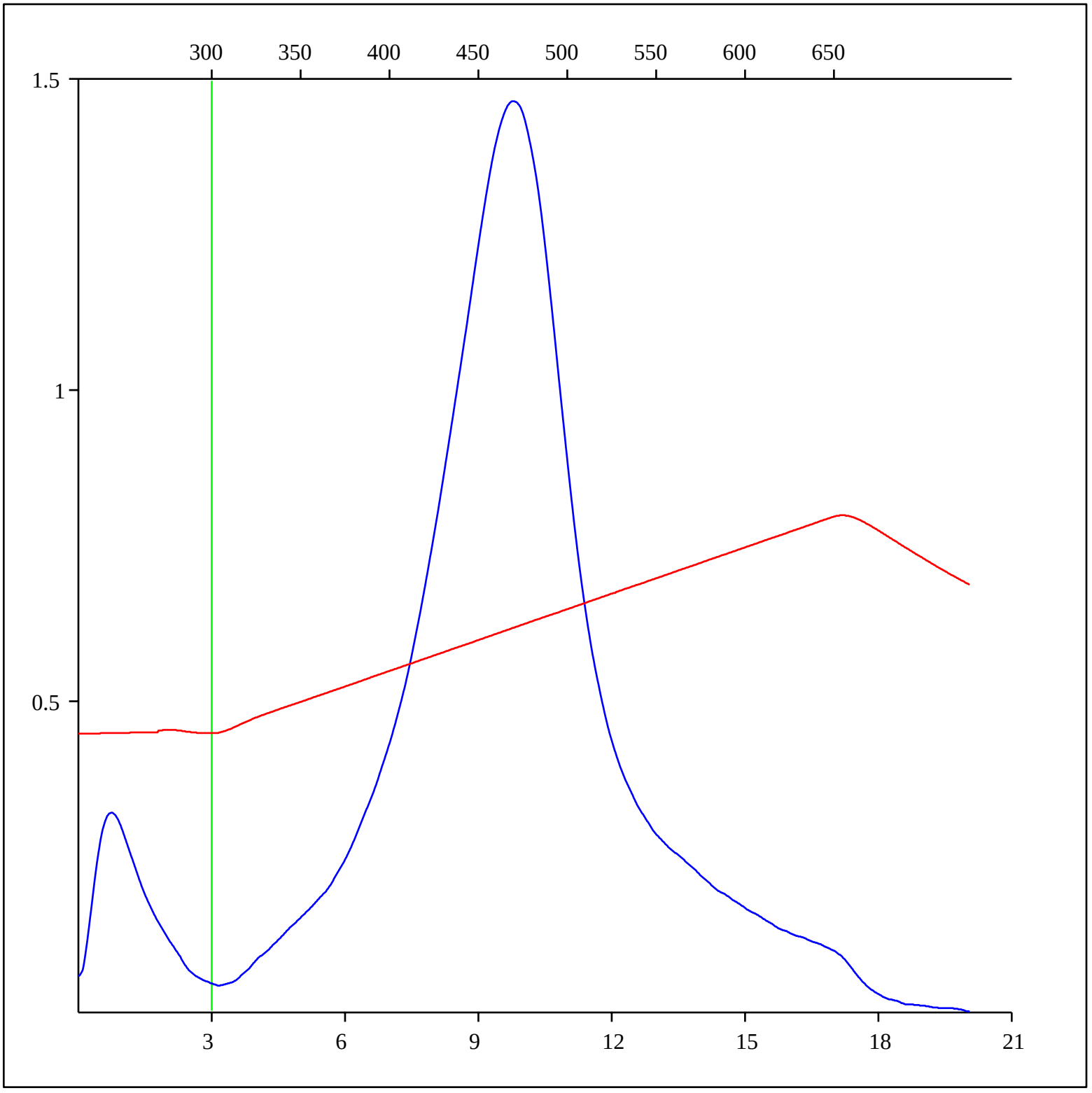
Sample: C-560335
Acquisition Date: 02-AUG-2013
Location: NIPTERK L-19
Depth: 2311.8 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



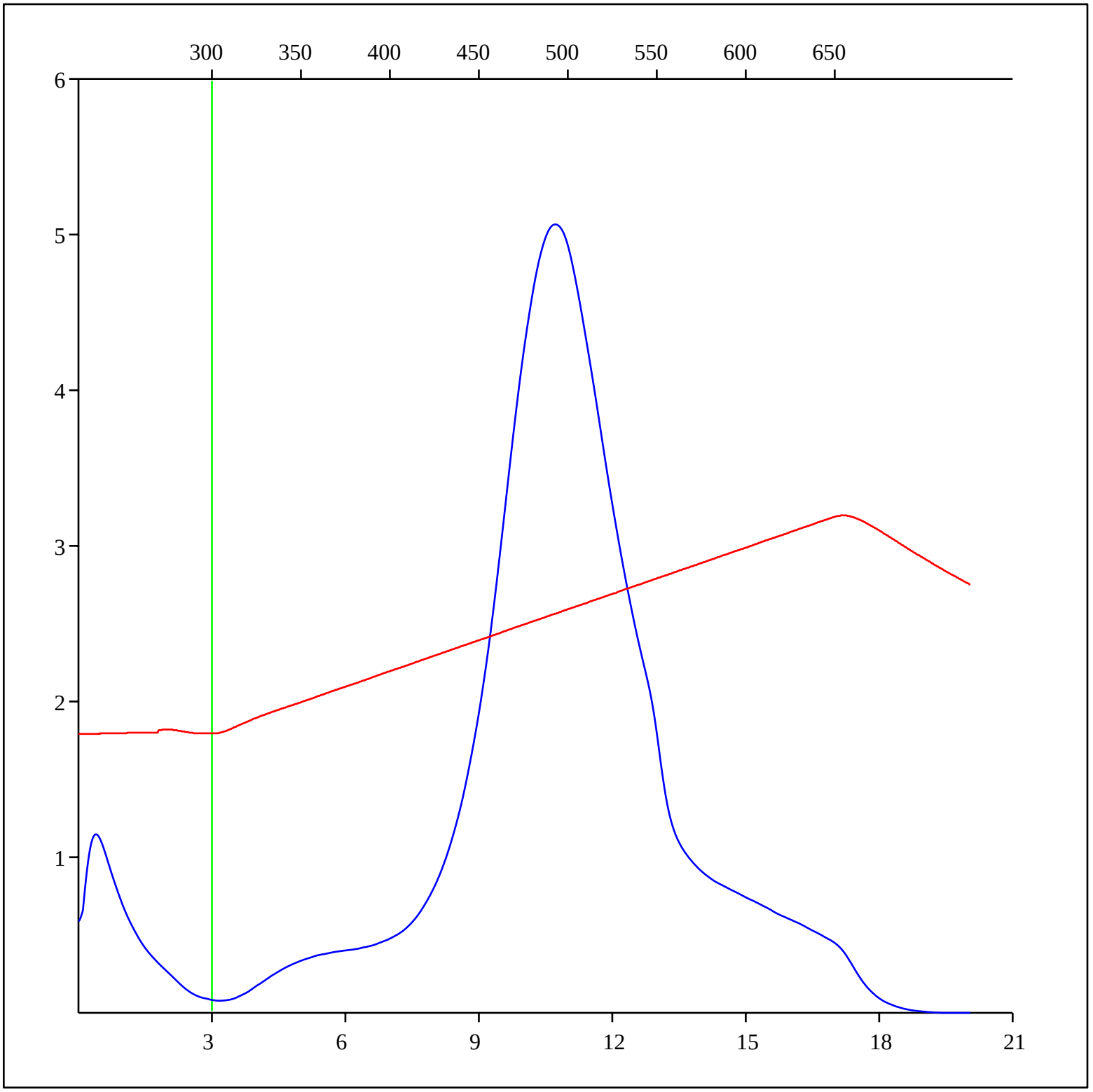
Sample: C-560336
Acquisition Date: 02-AUG-2013
Location: NIPTERK L-19
Depth: 2512 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



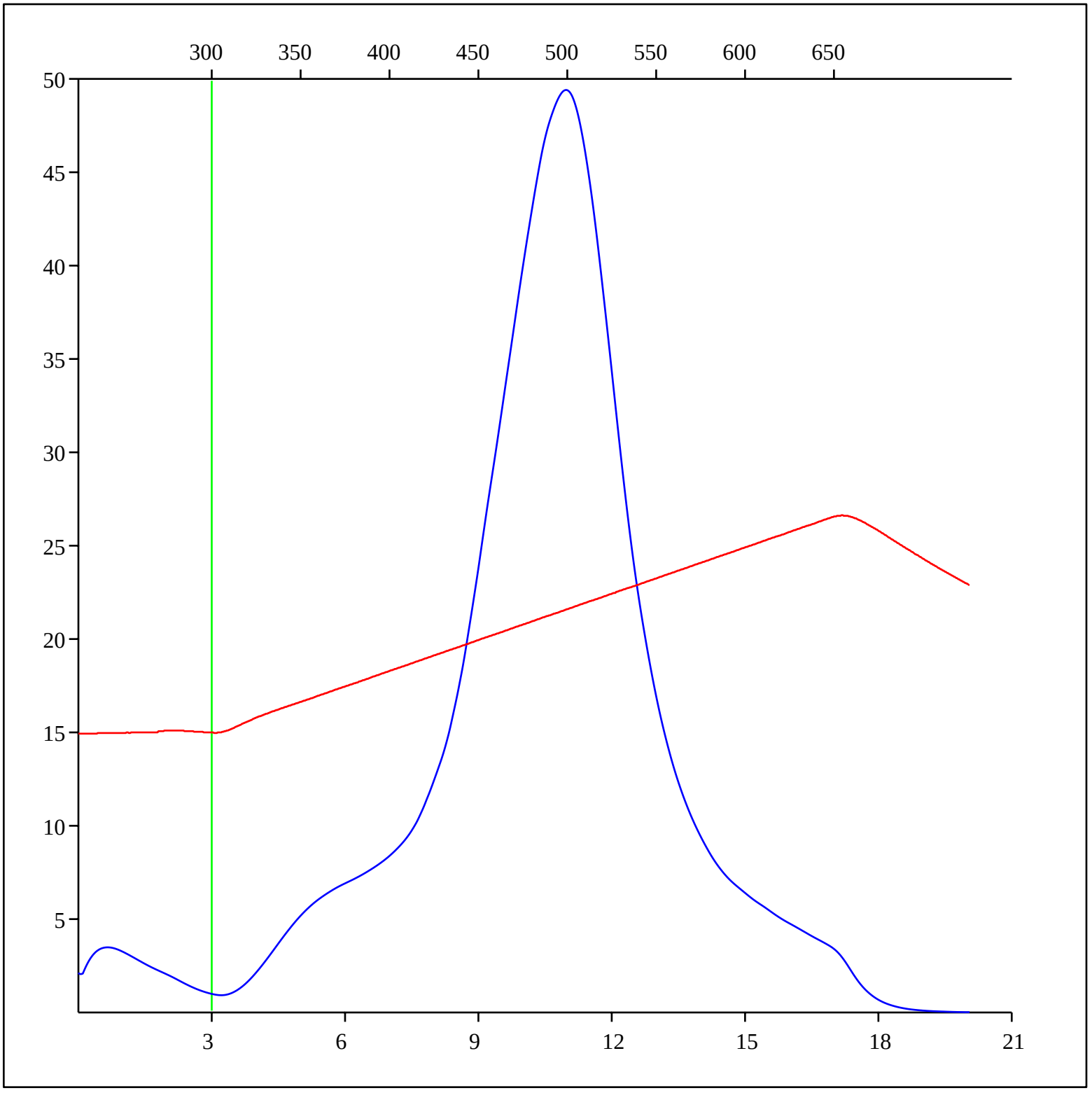
Sample: C-560337
Acquisition Date: 02-AUG-2013
Location: OGRUKNANG M-31
Depth: 4030.6 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



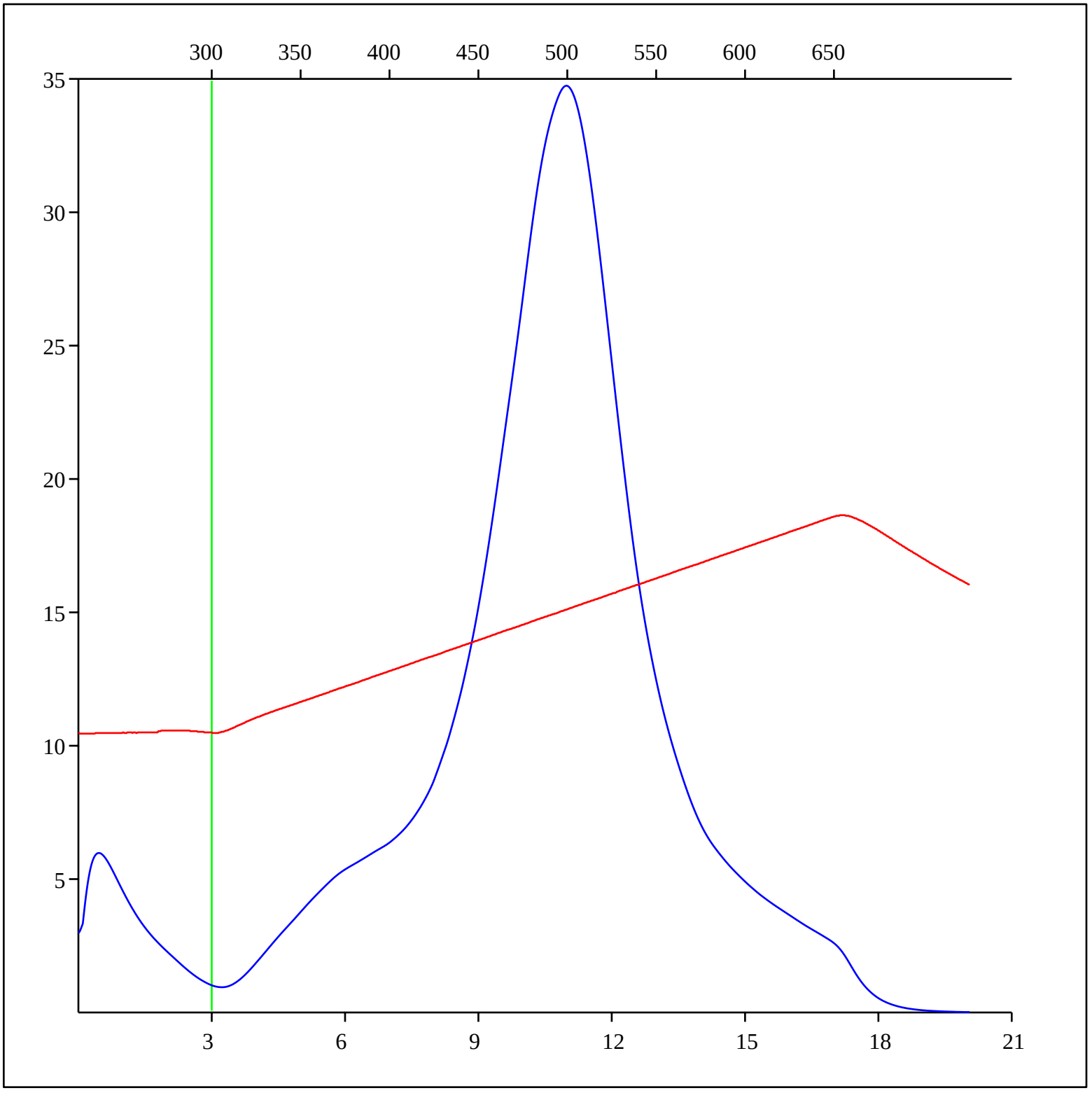
Sample: C-560338
Acquisition Date: 02-AUG-2013
Location: OGRUKNANG M-31
Depth: 4031.79 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



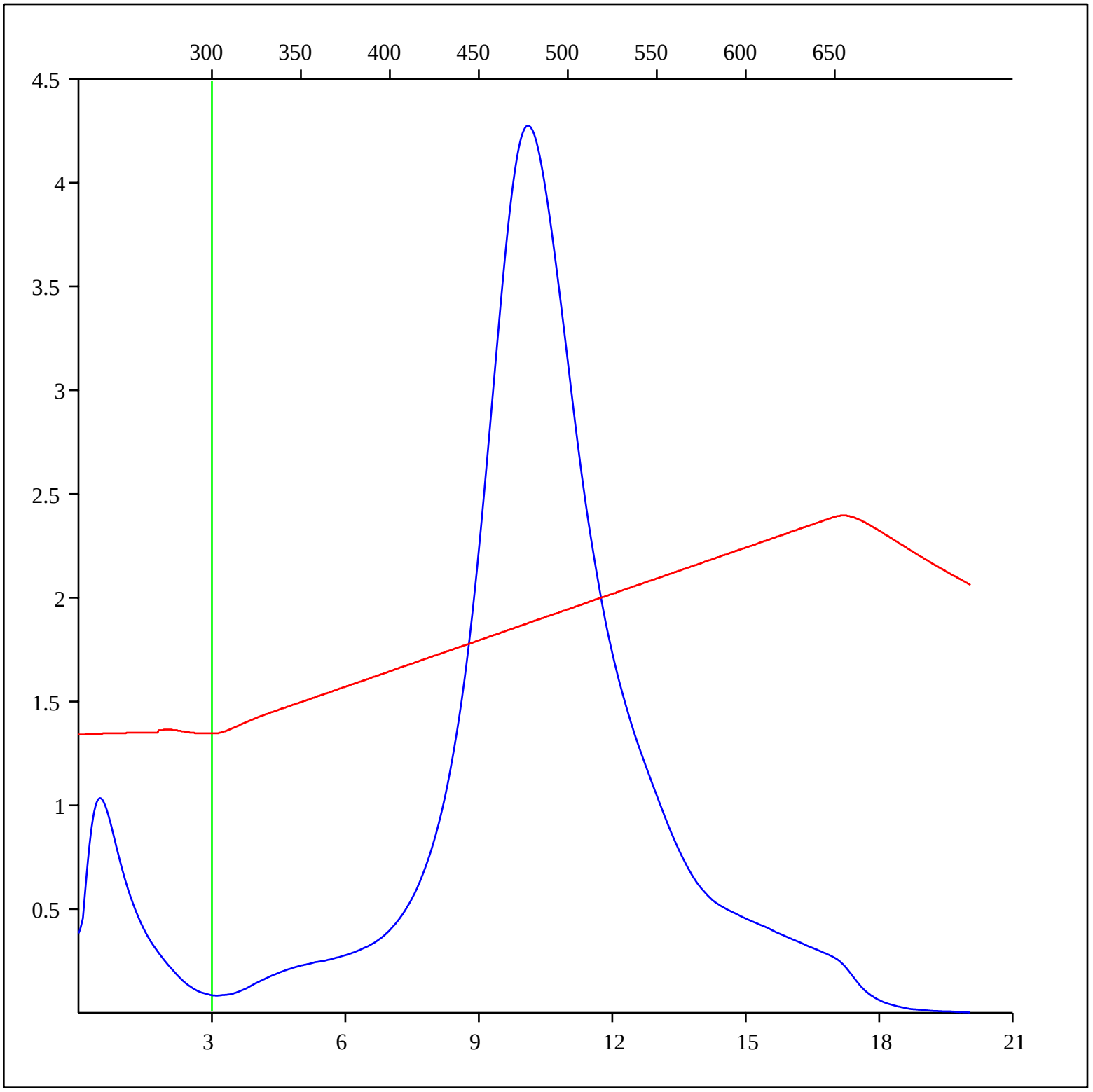
Sample: C-560339
Acquisition Date: 02-AUG-2013
Location: OGRUKNANG M-31
Depth: 4034.15 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



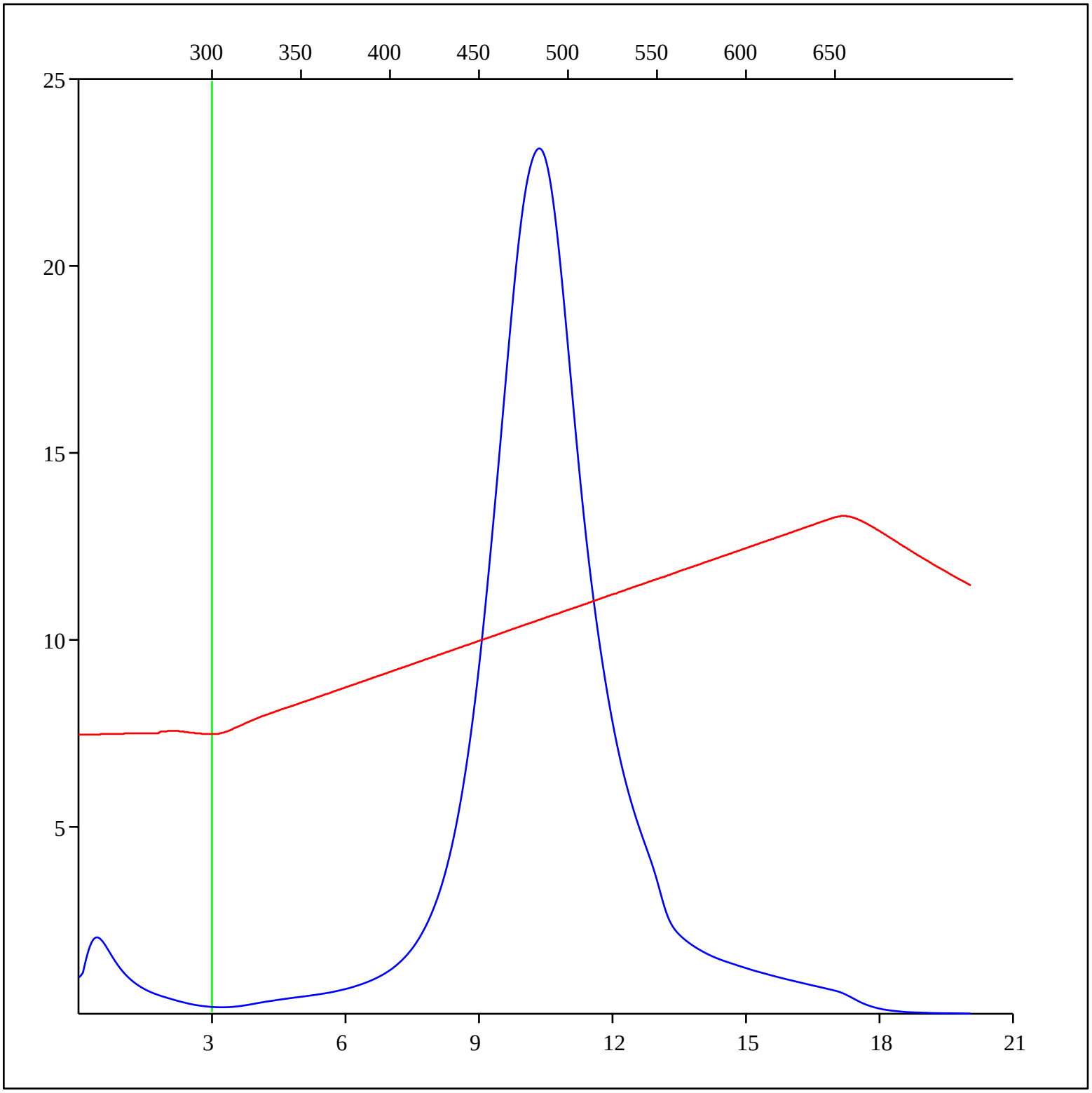
Sample: C-560340
Acquisition Date: 02-AUG-2013
Location: PARSONS F-09
Depth: 2855.26 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



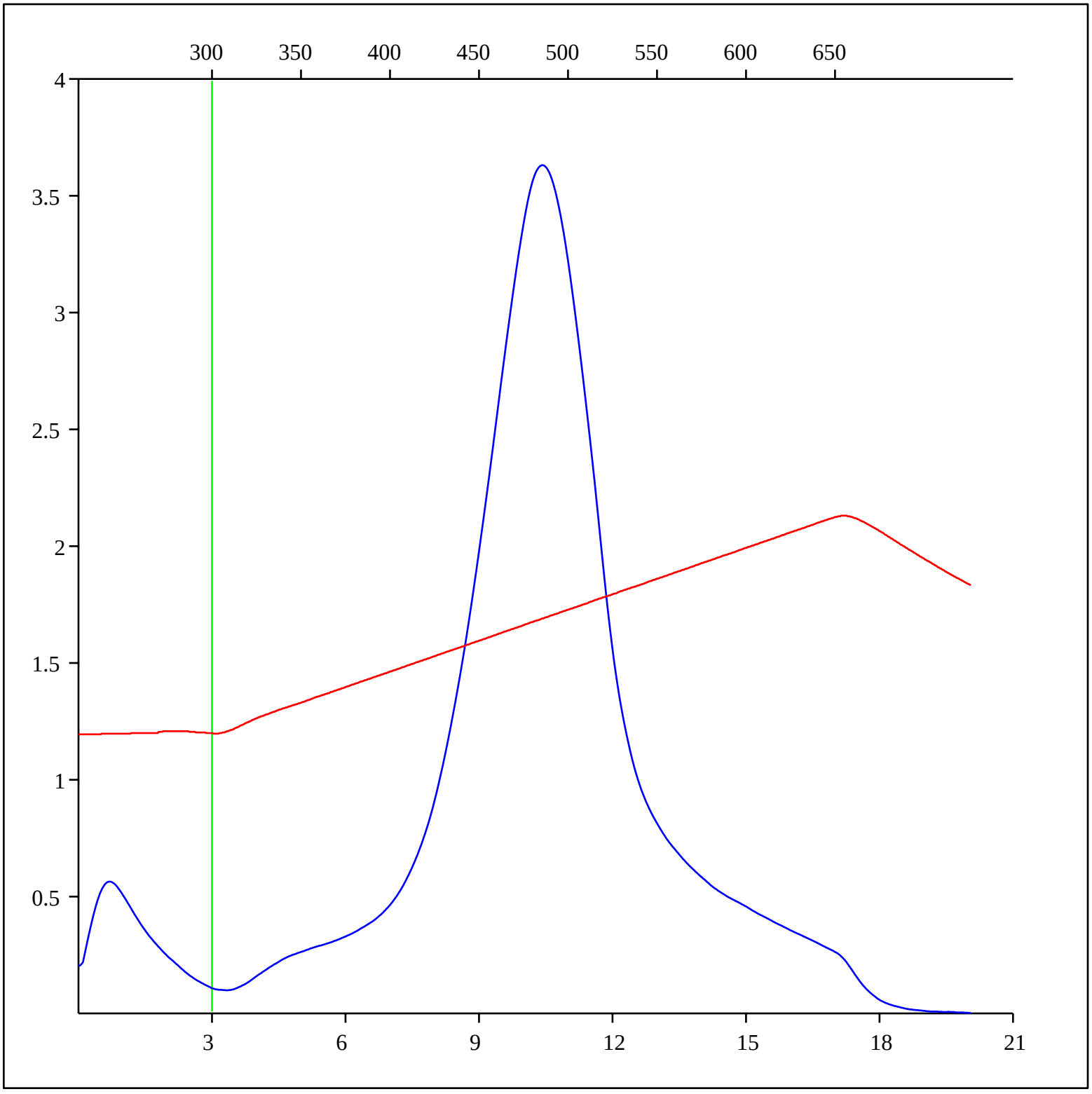
Sample: C-560341
Acquisition Date: 02-AUG-2013
Location: PARSONS F-09
Depth: 2993.23 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



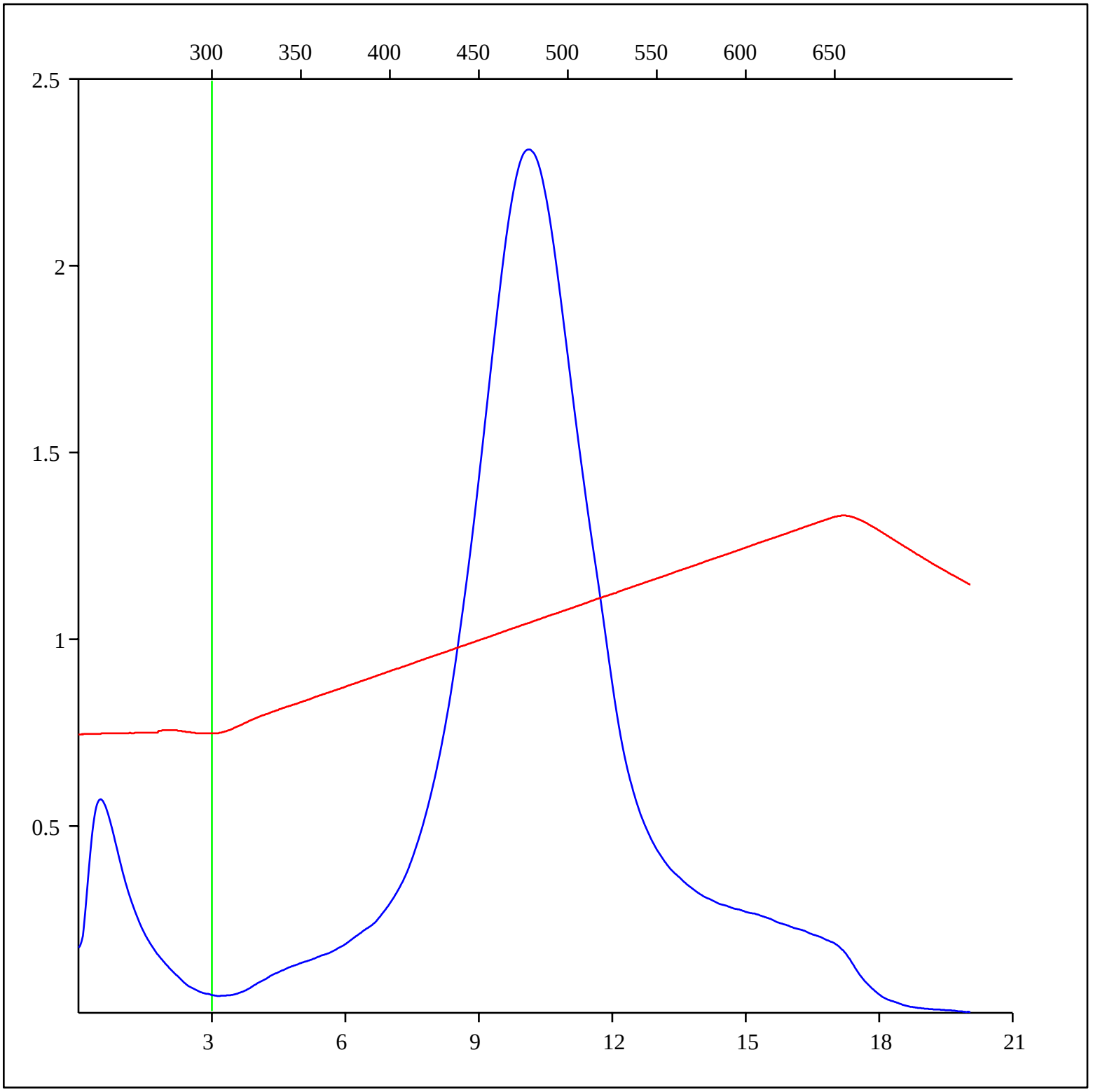
Sample: C-560342
Acquisition Date: 02-AUG-2013
Location: PARSONS L-43
Depth: 2776.65 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



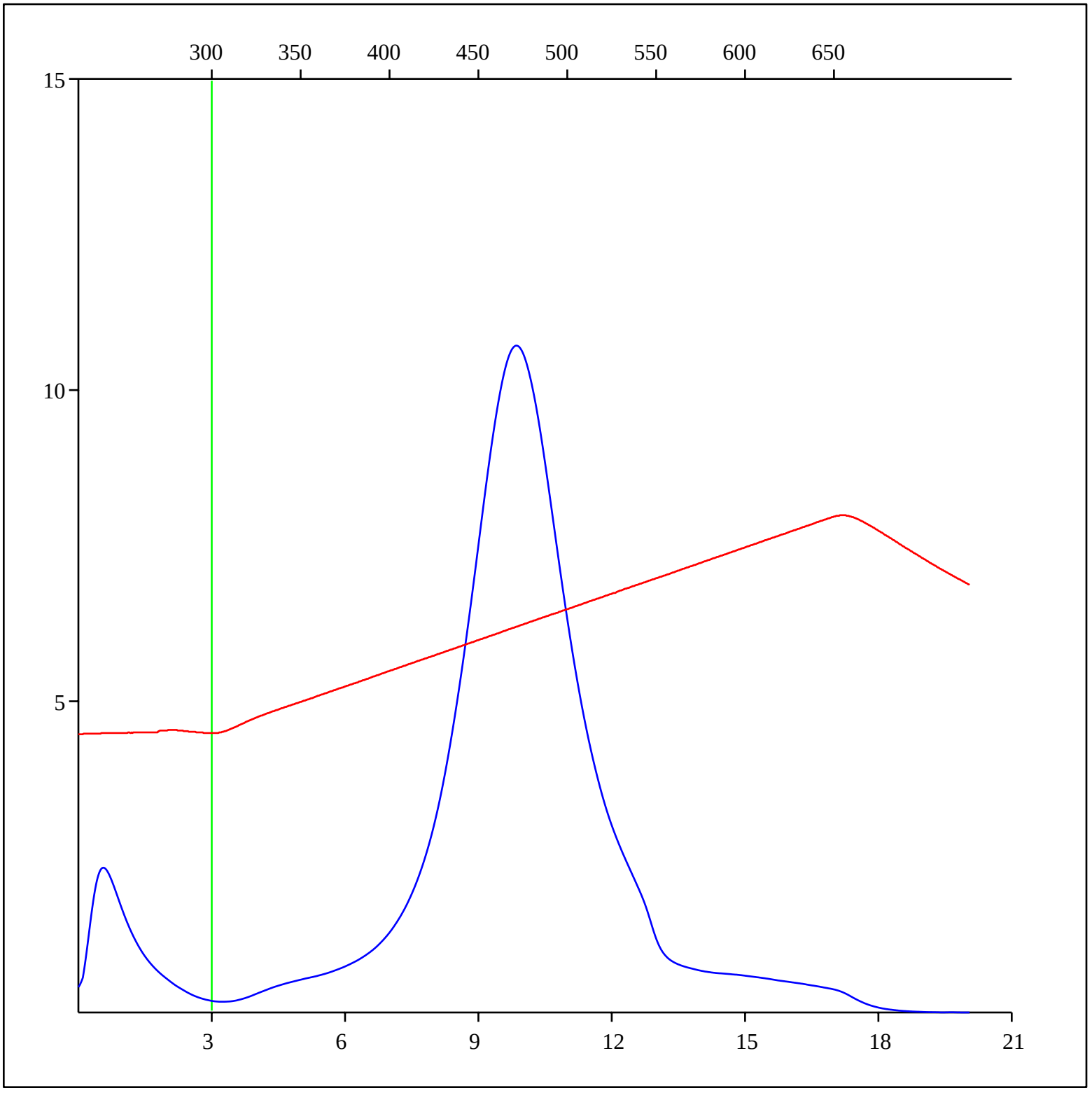
Sample: C-560343
Acquisition Date: 02-AUG-2013
Location: PARSONS L-43
Depth: 2856.9 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



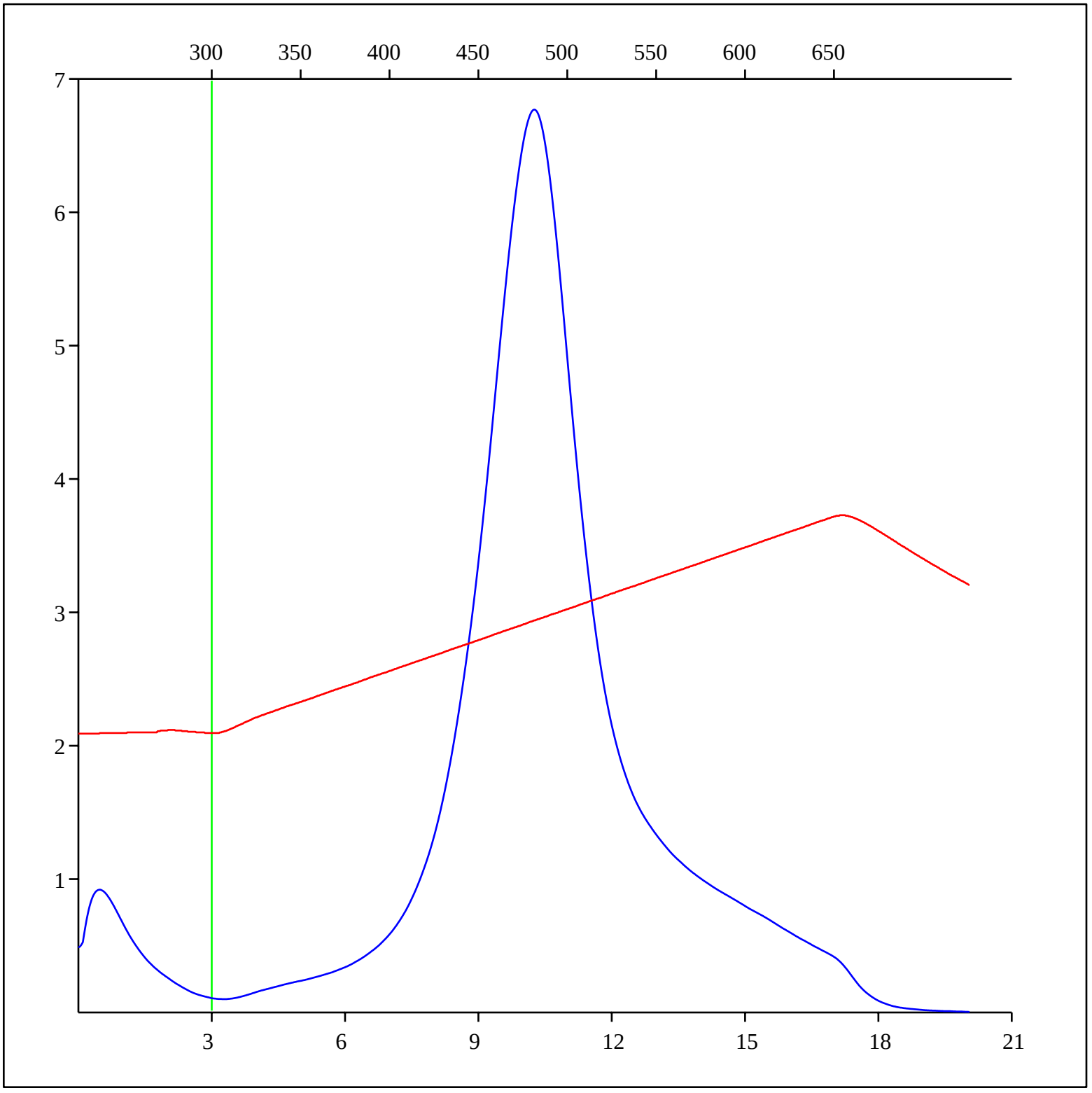
Sample: C-560344
Acquisition Date: 02-AUG-2013
Location: PARSONS N-10
Depth: 2762.6 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



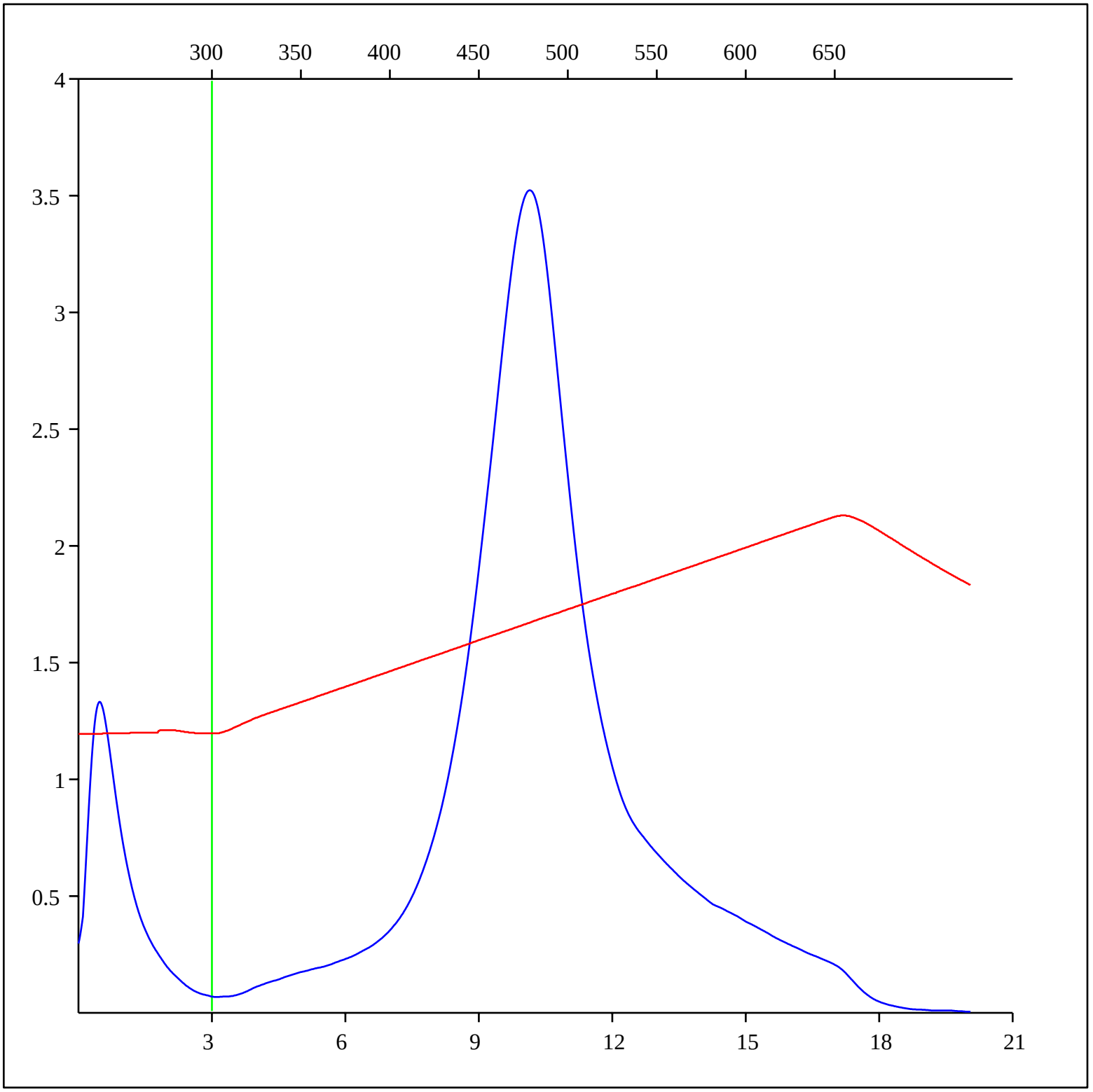
Sample: C-560345
Acquisition Date: 02-AUG-2013
Location: PARSONS N-10
Depth: 2845.4 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



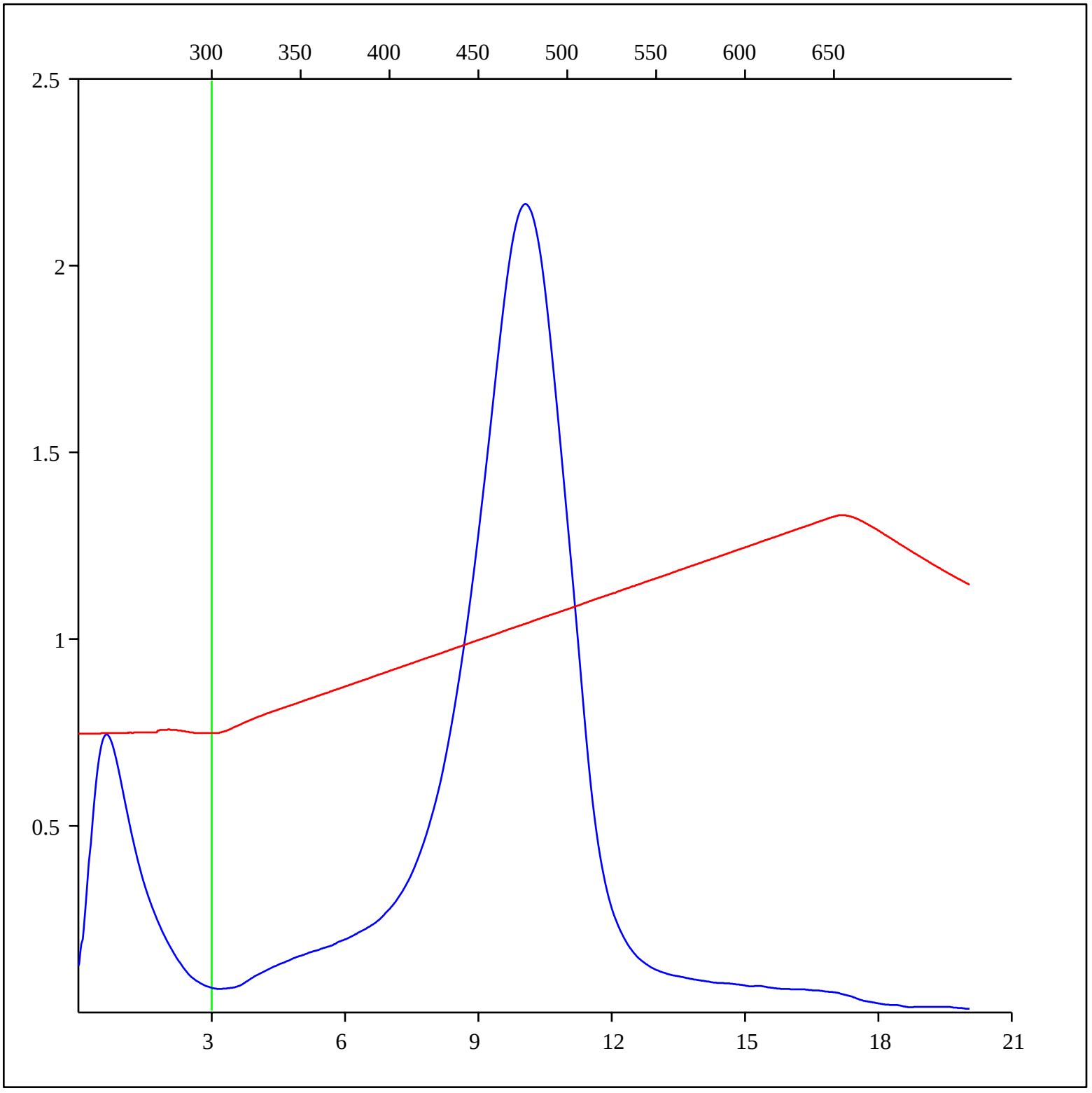
Sample: C-560346
Acquisition Date: 02-AUG-2013
Location: PARSONS N-10
Depth: 2897.38 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



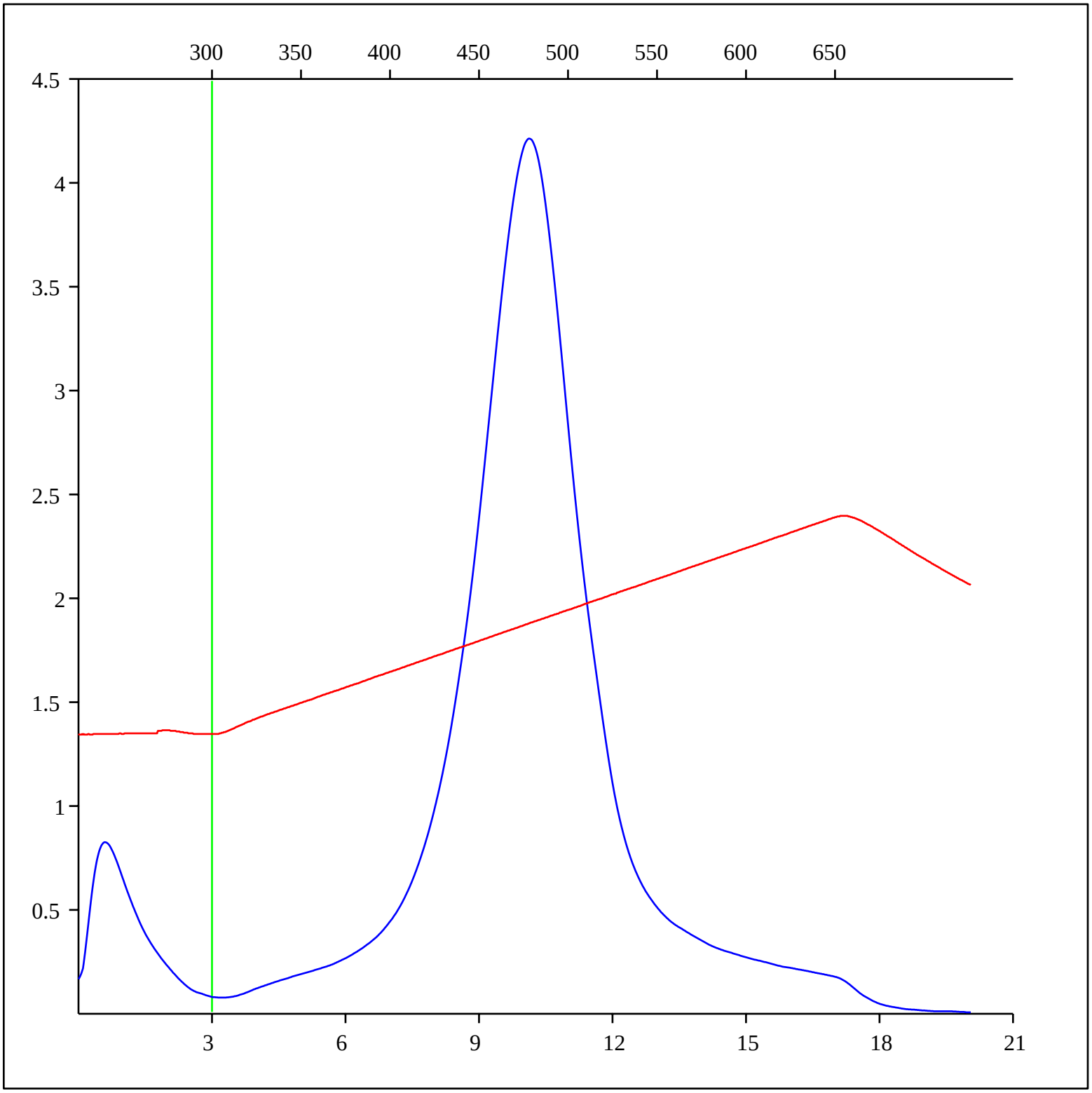
Sample: C-560347
Acquisition Date: 02-AUG-2013
Location: PIKIOLIK E-54
Depth: 2687.95 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



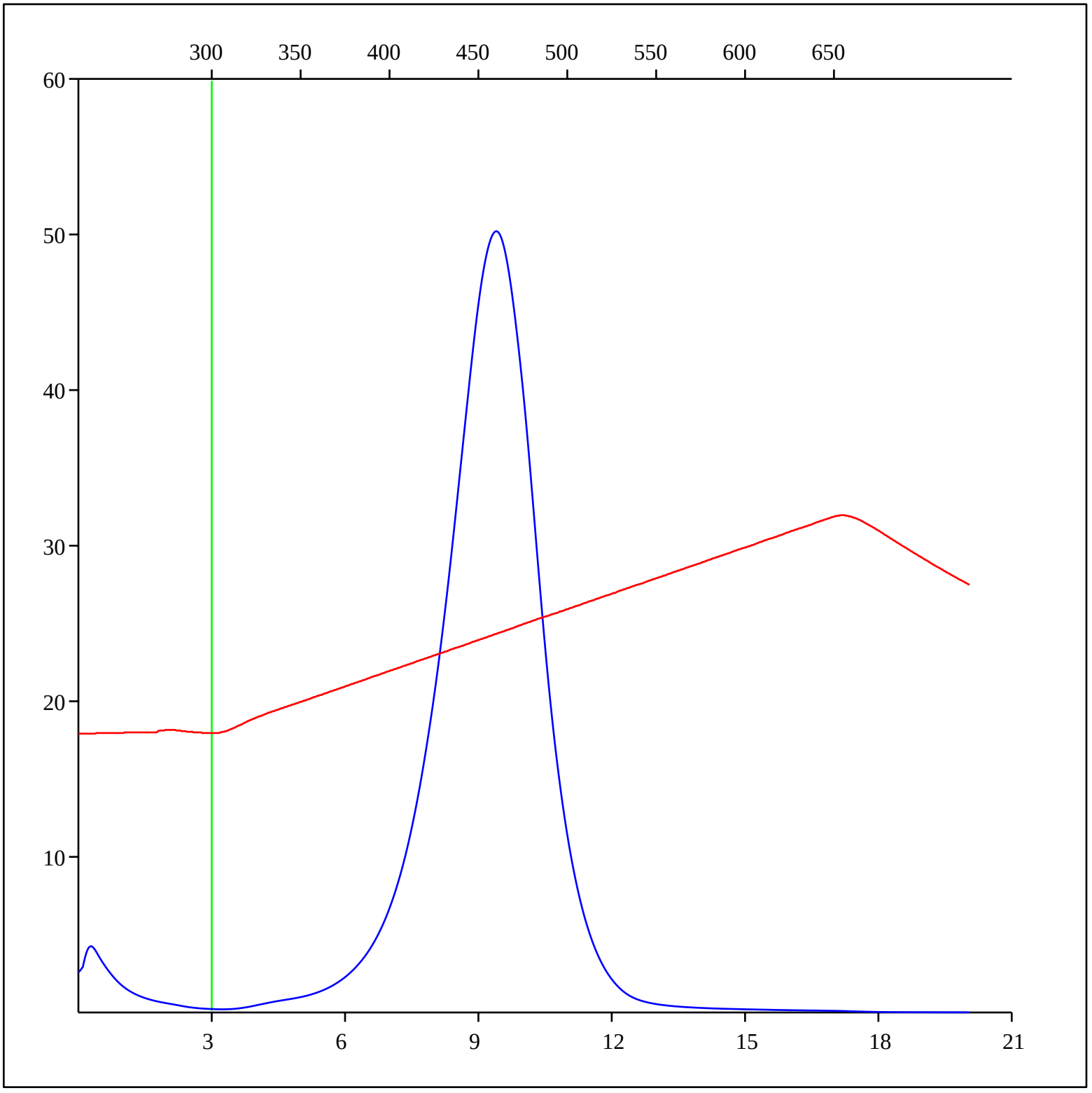
Sample: C-560348
Acquisition Date: 02-AUG-2013
Location: PIKIOLIK E-54
Depth: 2703.2 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



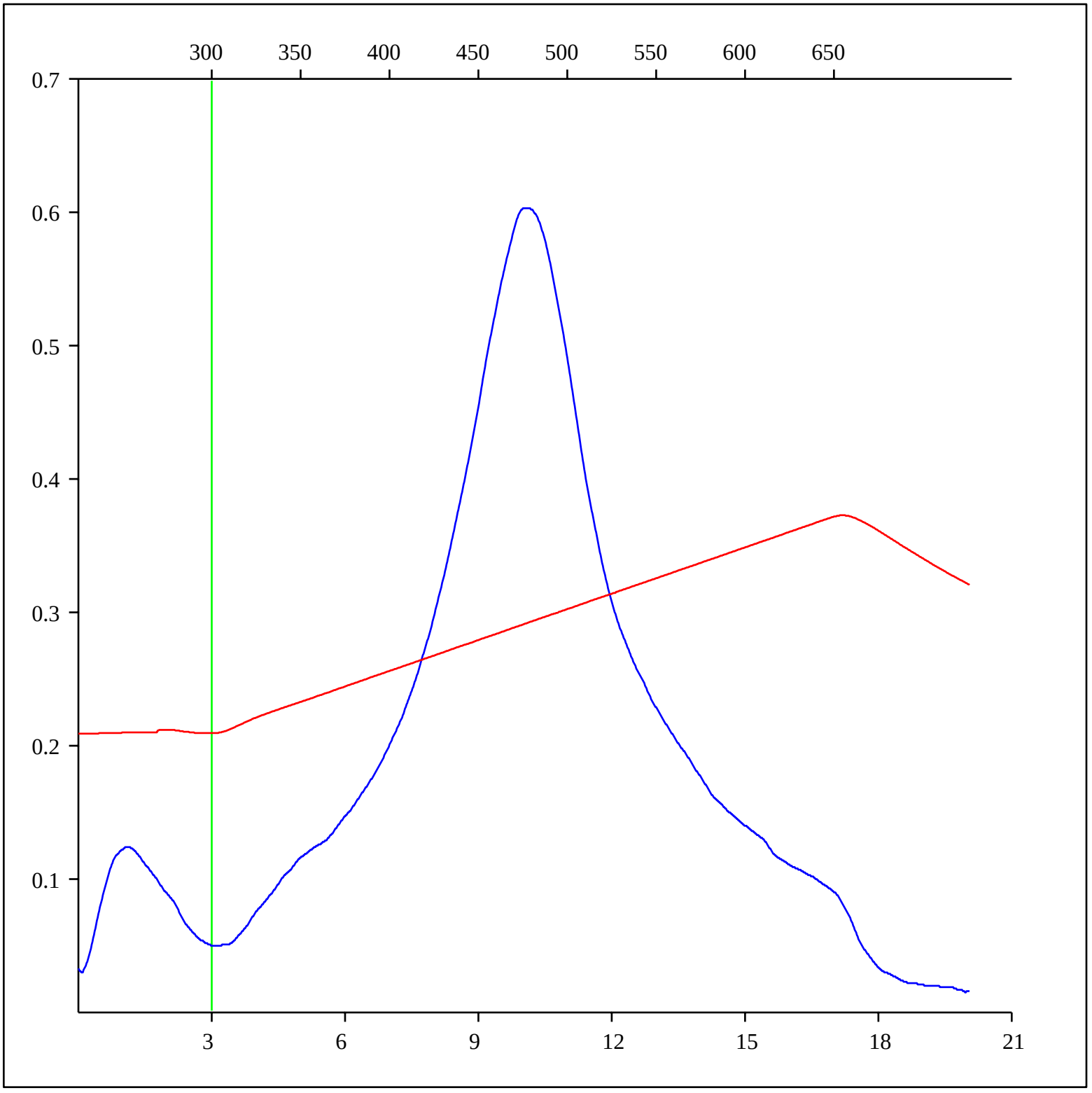
Sample: C-560349
Acquisition Date: 02-AUG-2013
Location: PIKIOLIK G-21
Depth: 1316.25 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



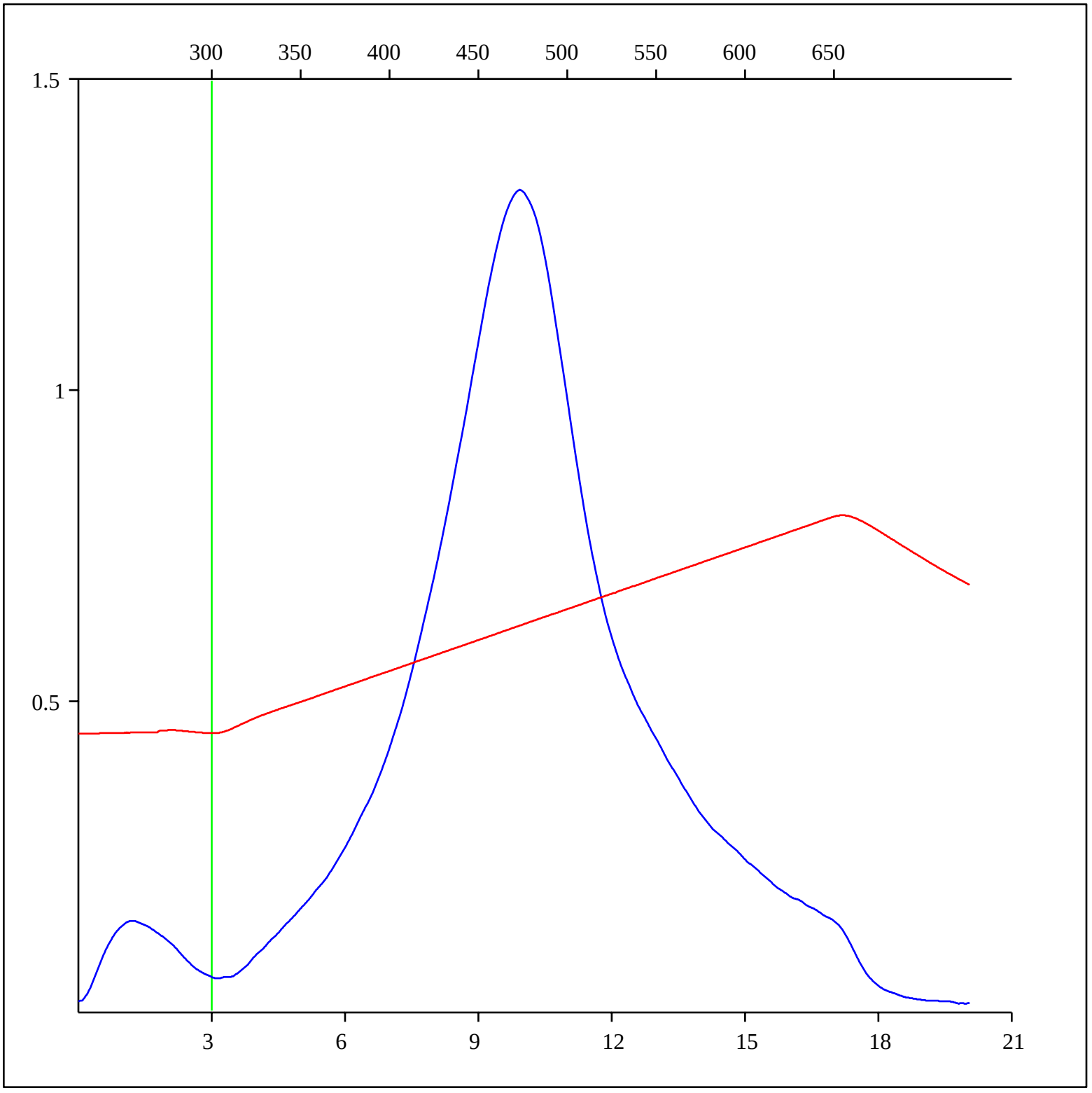
Sample: C-560350
Acquisition Date: 02-AUG-2013
Location: PIKIOLIK M-26
Depth: 708.12 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



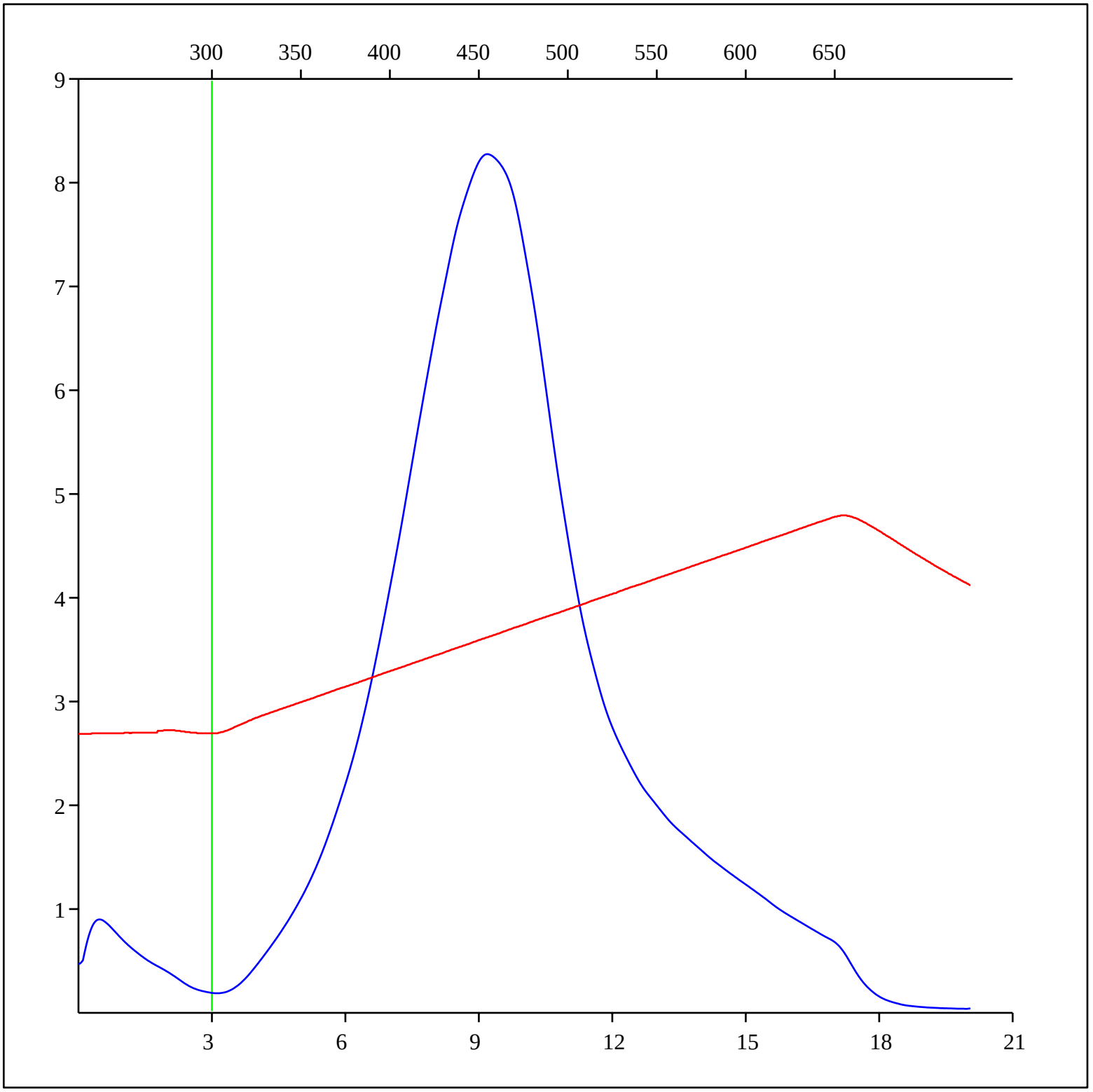
Sample: C-560351
Acquisition Date: 02-AUG-2013
Location: PIKIOLIK M-26
Depth: 864.75 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



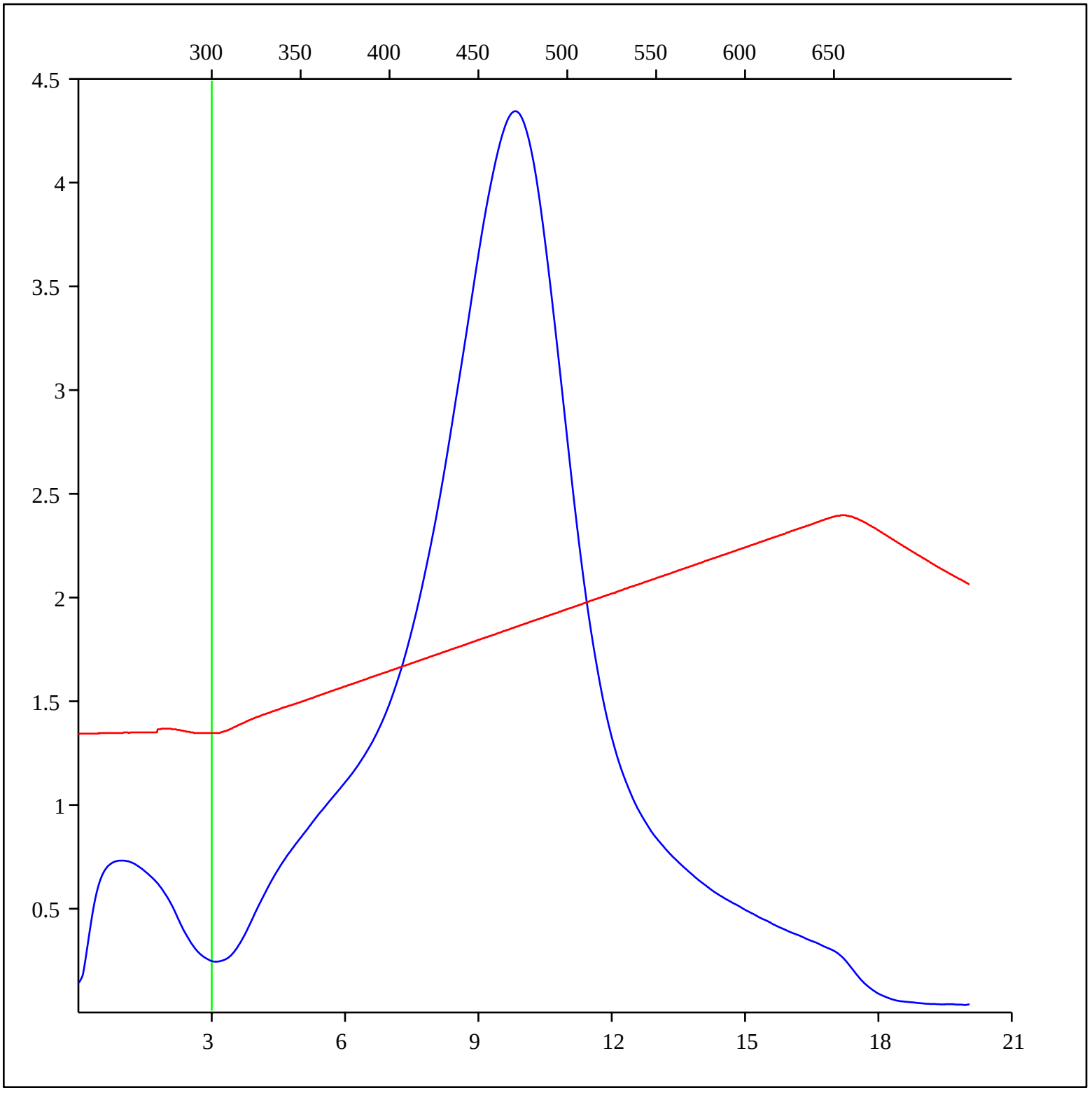
Sample: C-560352
Acquisition Date: 02-AUG-2013
Location: REINDEER D-27
Depth: 1129.3 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



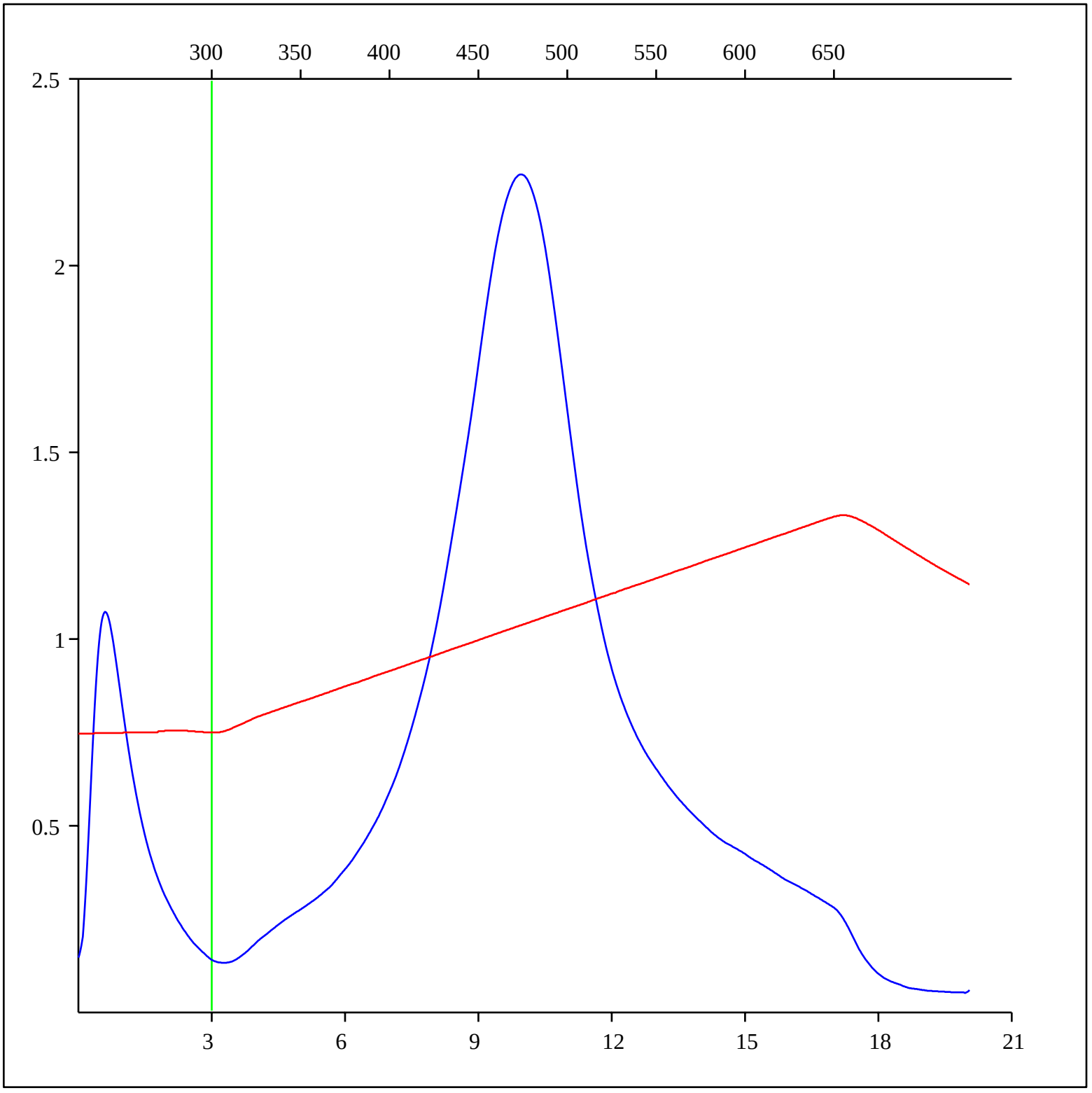
Sample: C-560353
Acquisition Date: 02-AUG-2013
Location: REINDEER D-27
Depth: 2021 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



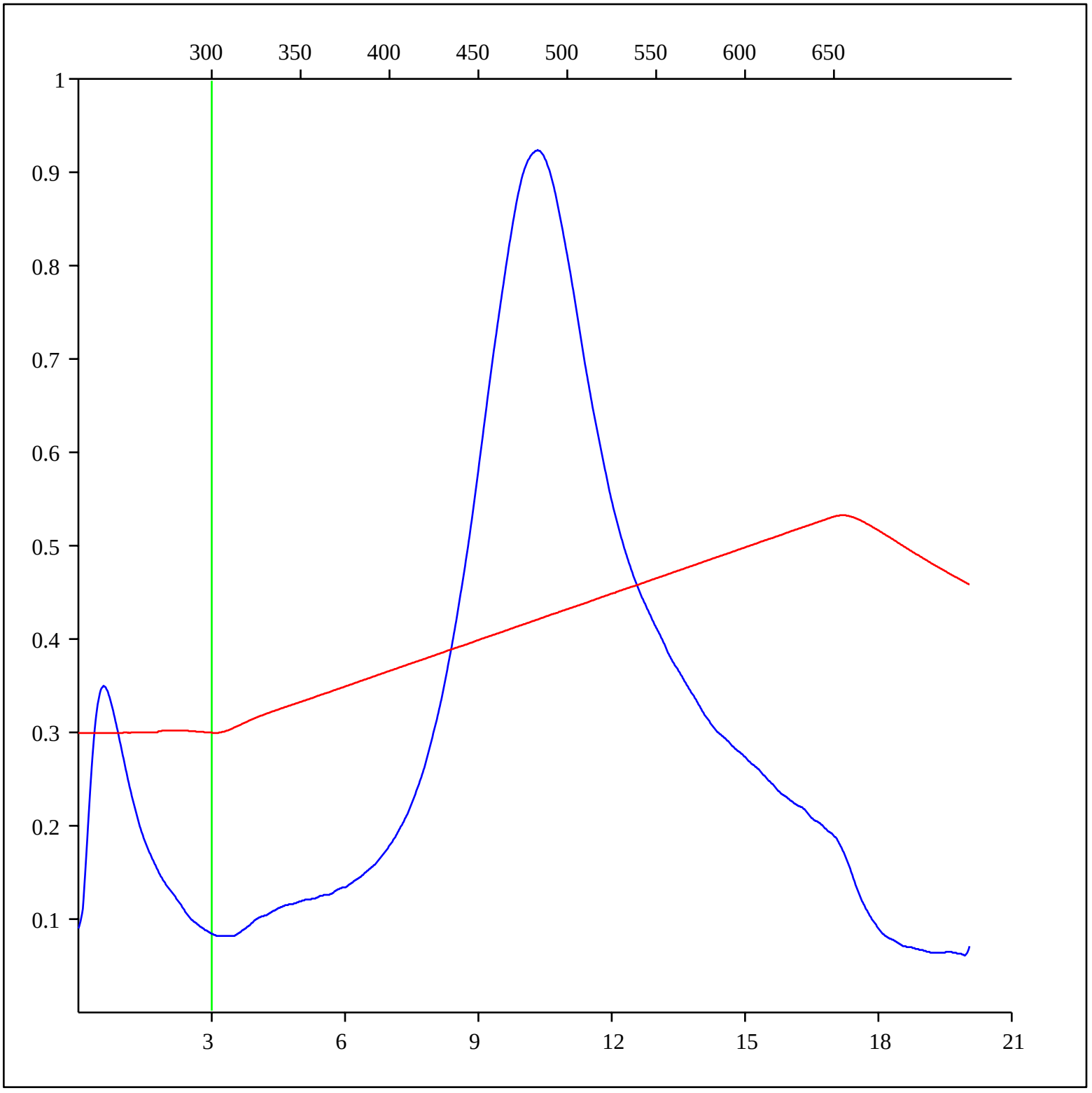
Sample: C-560354
Acquisition Date: 02-AUG-2013
Location: REINDEER D-27
Depth: 2723.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



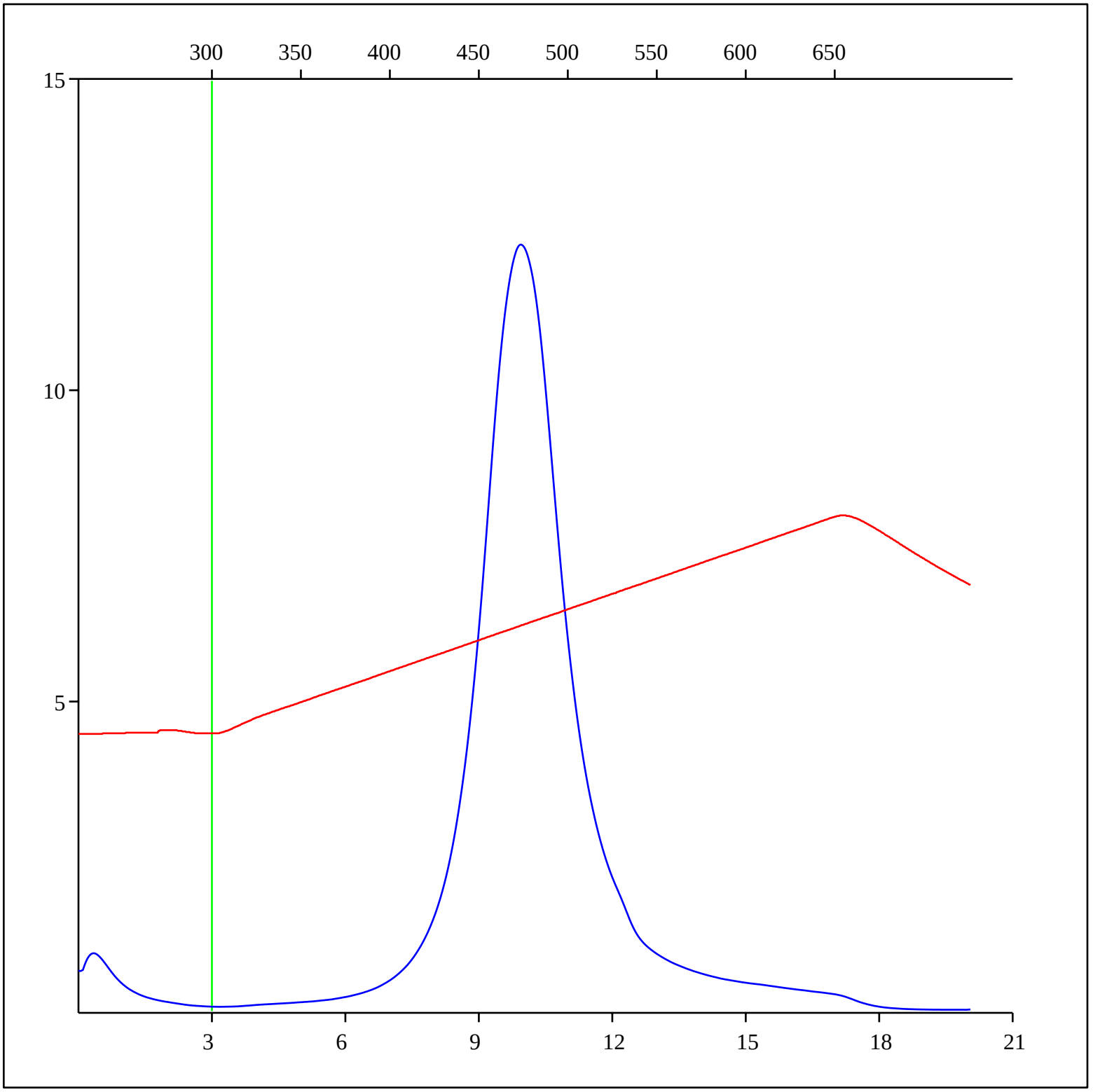
Sample: C-560355
Acquisition Date: 02-AUG-2013
Location: REINDEER D-27
Depth: 3157 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



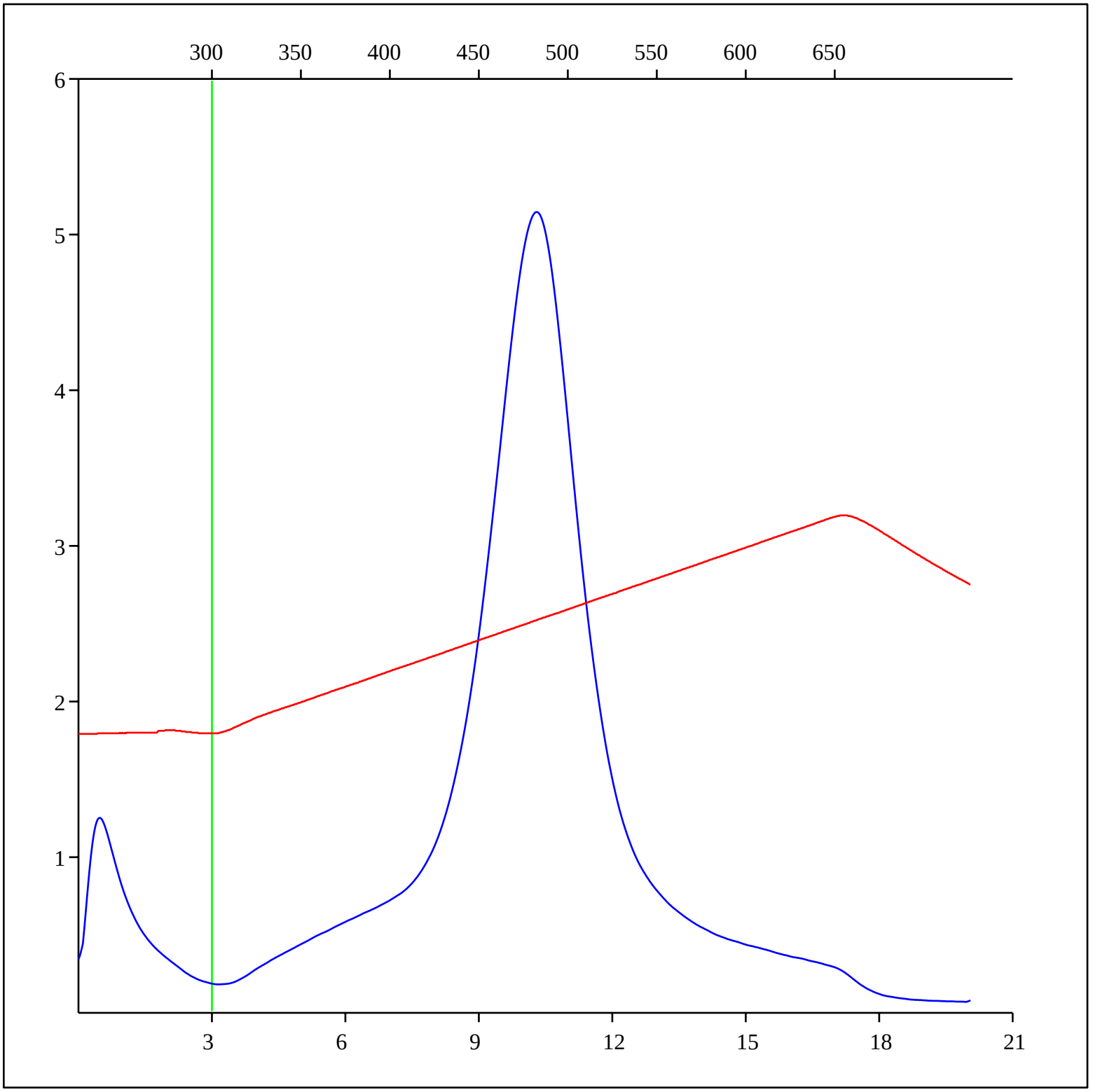
Sample: C-560356
Acquisition Date: 02-AUG-2013
Location: REINDEER D-27
Depth: 3313.62 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



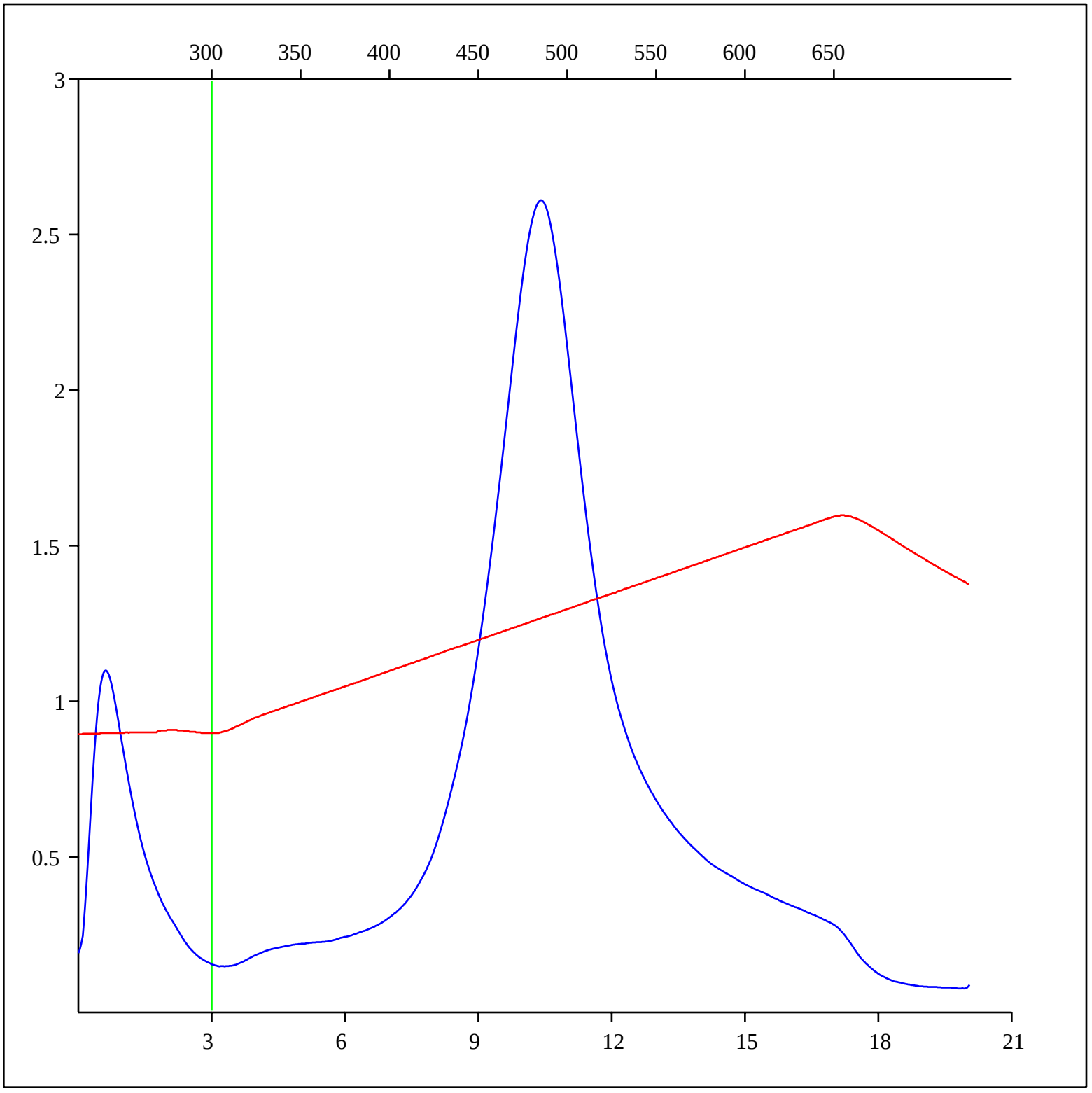
Sample: C-560357
Acquisition Date: 02-AUG-2013
Location: REINDEER D-27
Depth: 3481.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



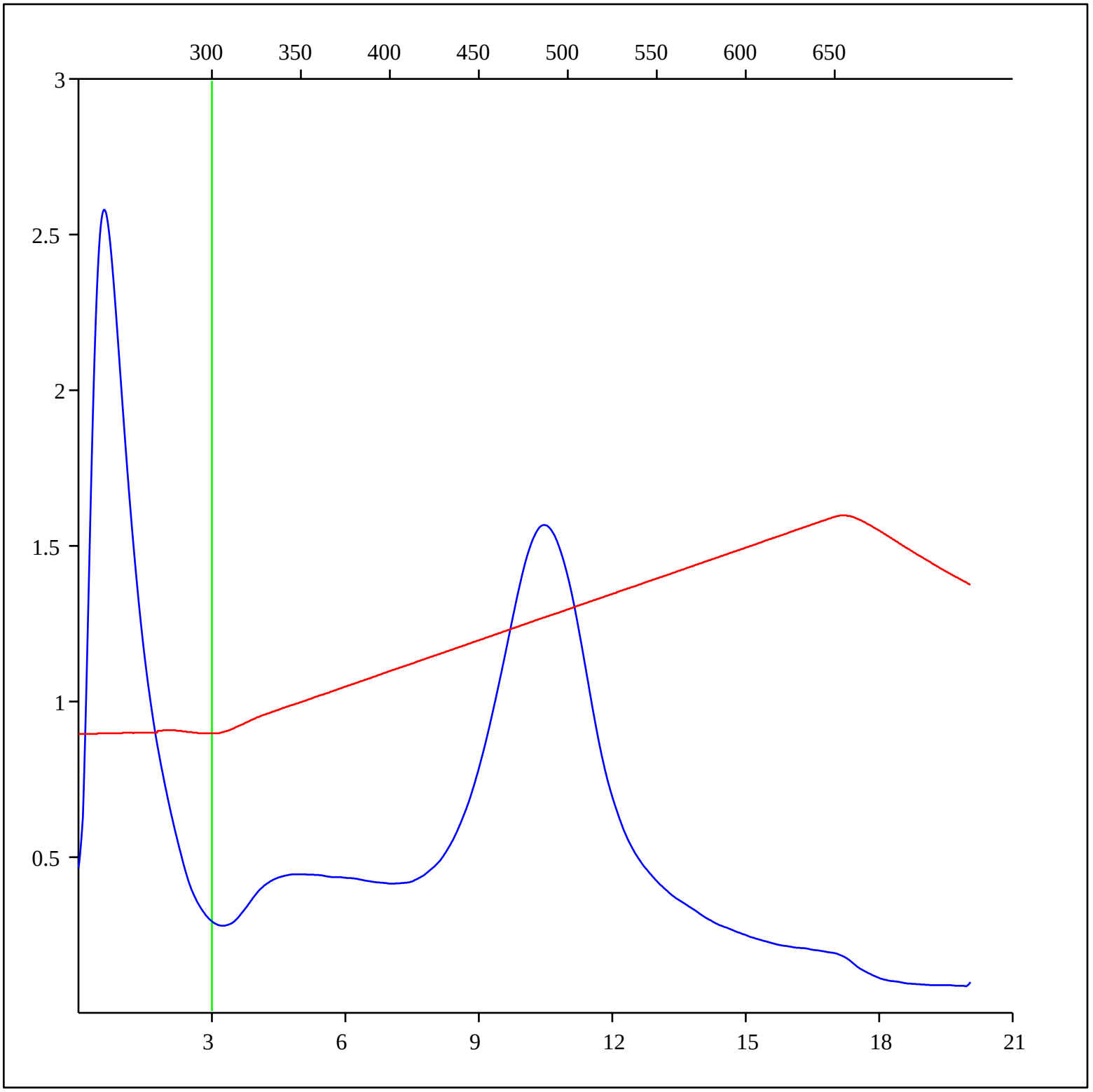
Sample: C-560358
Acquisition Date: 02-AUG-2013
Location: REINDEER D-27
Depth: 3623.35 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



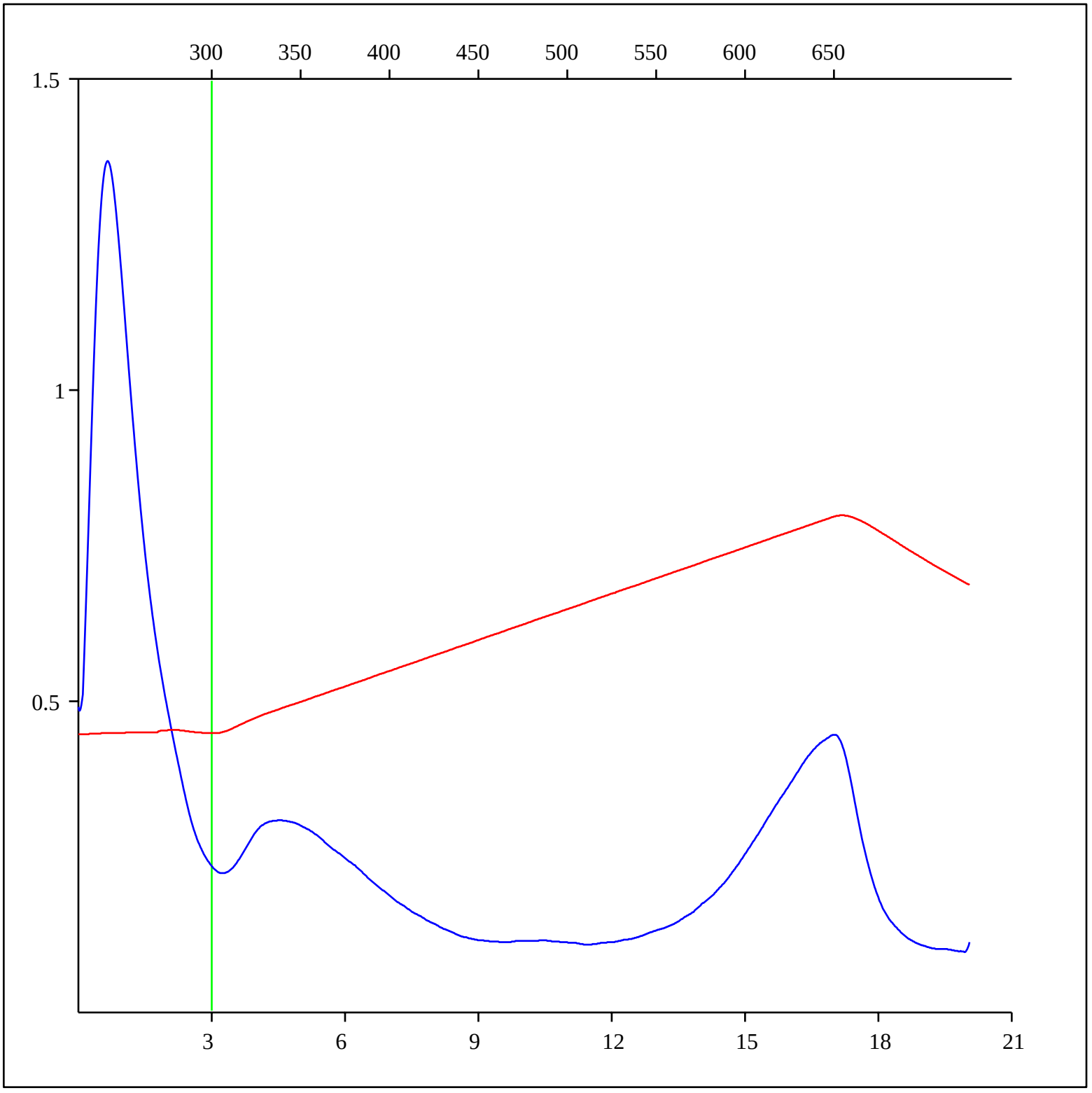
Sample: C-560359
Acquisition Date: 02-AUG-2013
Location: REINDEER D-27
Depth: 3798.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



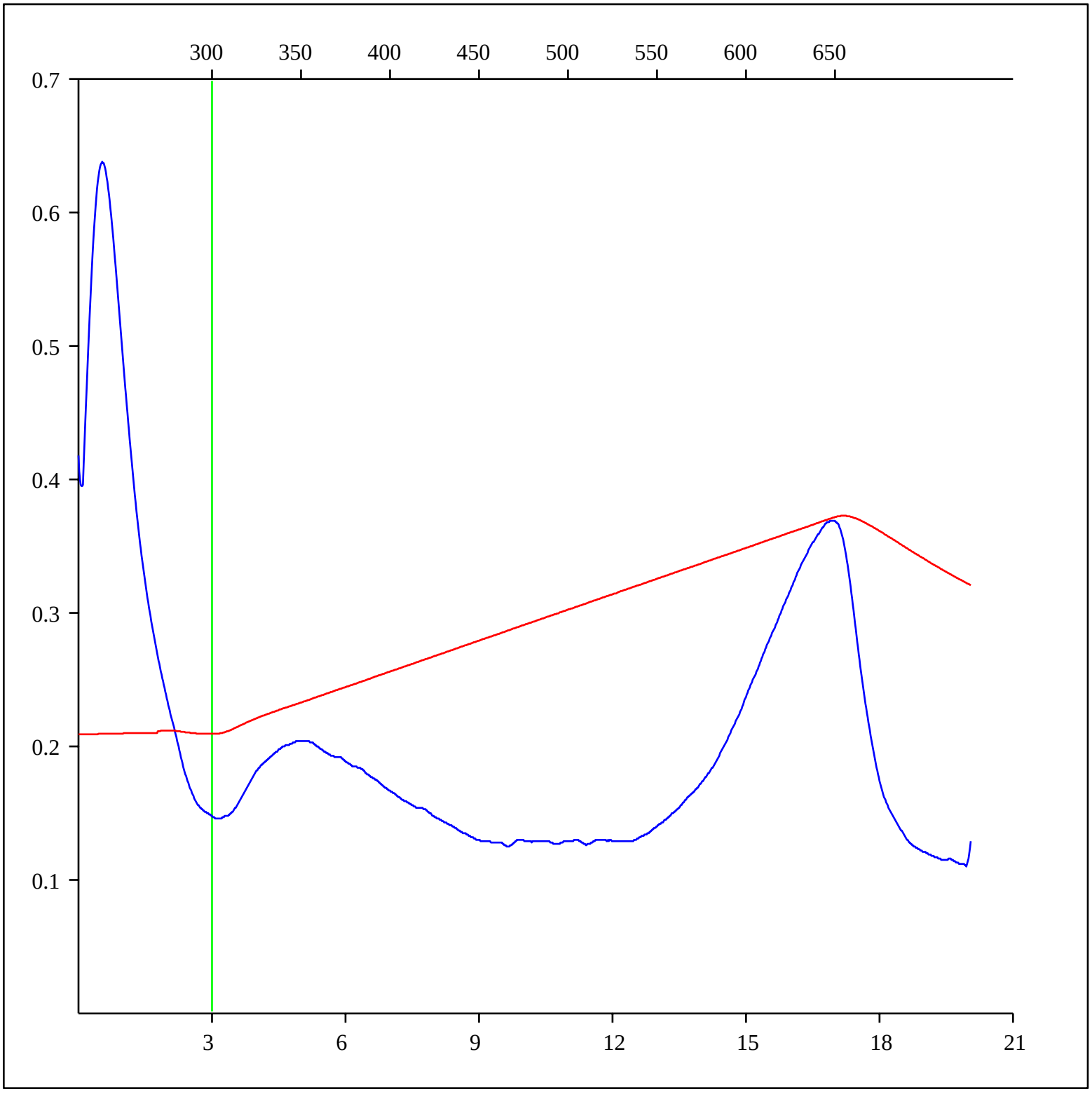
Sample: C-560360
Acquisition Date: 02-AUG-2013
Location: ROLAND BAY Y.T. L-41
Depth: 671.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



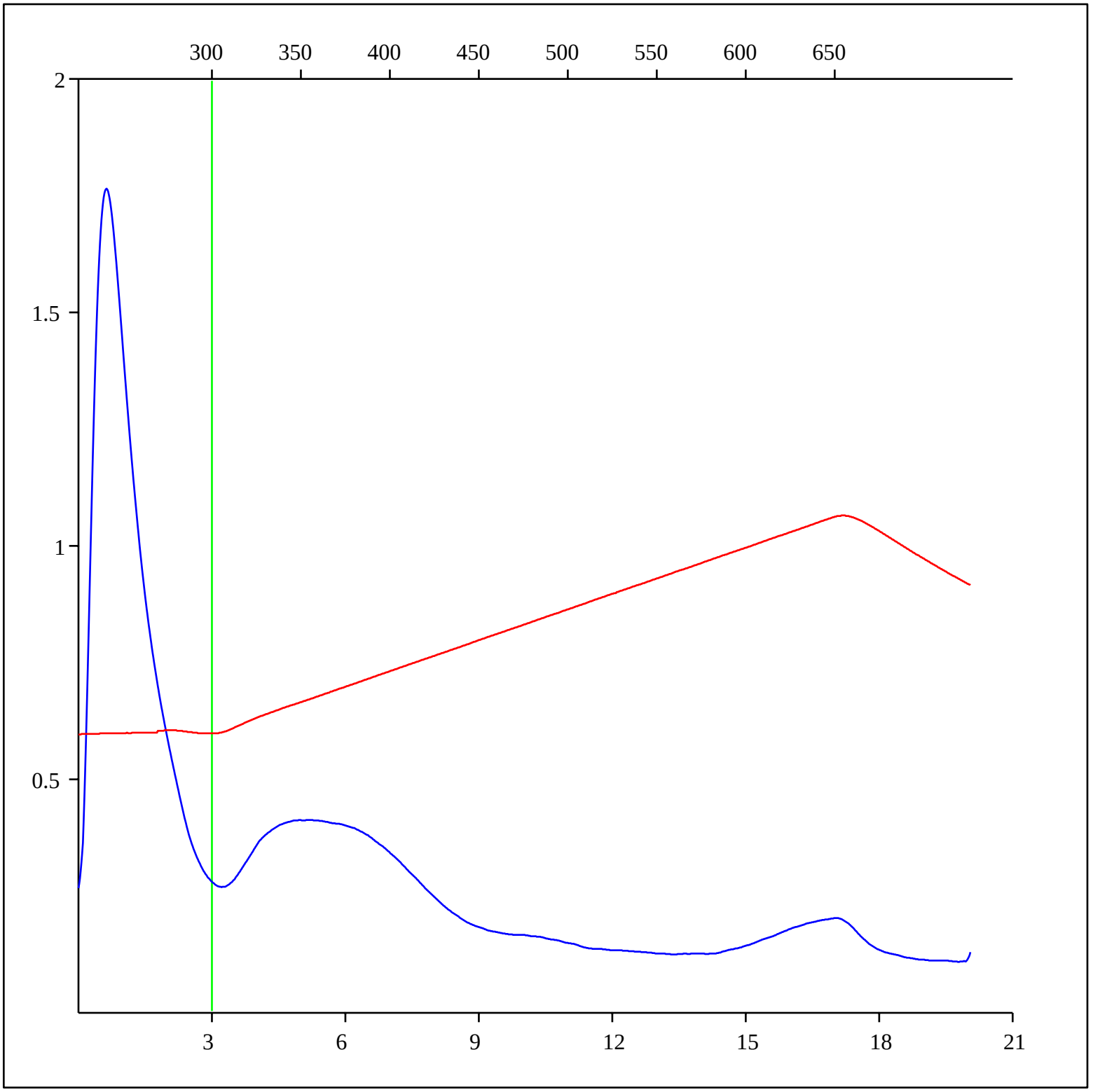
Sample: C-560361
Acquisition Date: 02-AUG-2013
Location: ROLAND BAY Y.T. L-41
Depth: 679.6 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



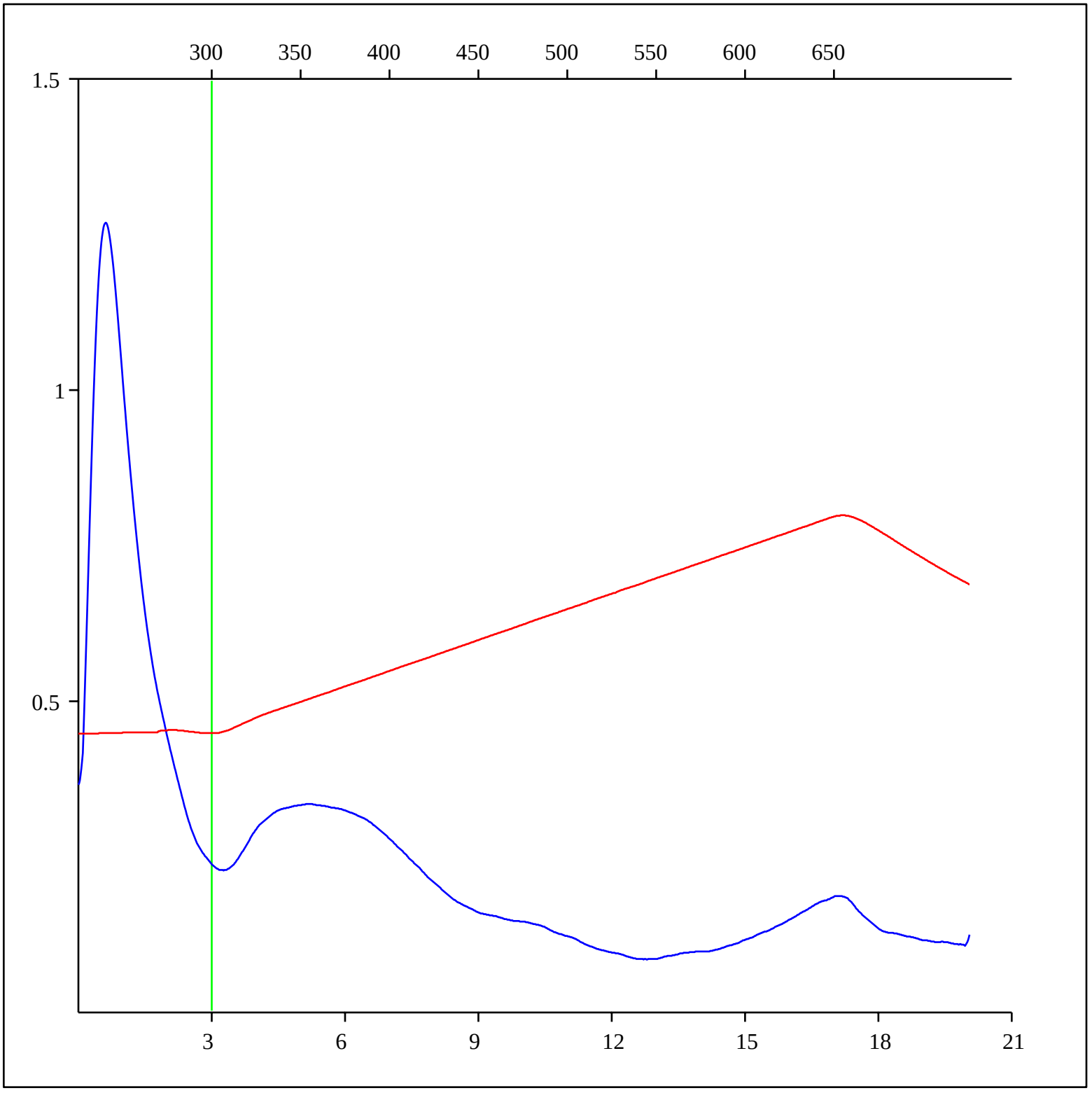
Sample: C-560362
Acquisition Date: 02-AUG-2013
Location: ROLAND BAY Y.T. L-41
Depth: 980.2 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



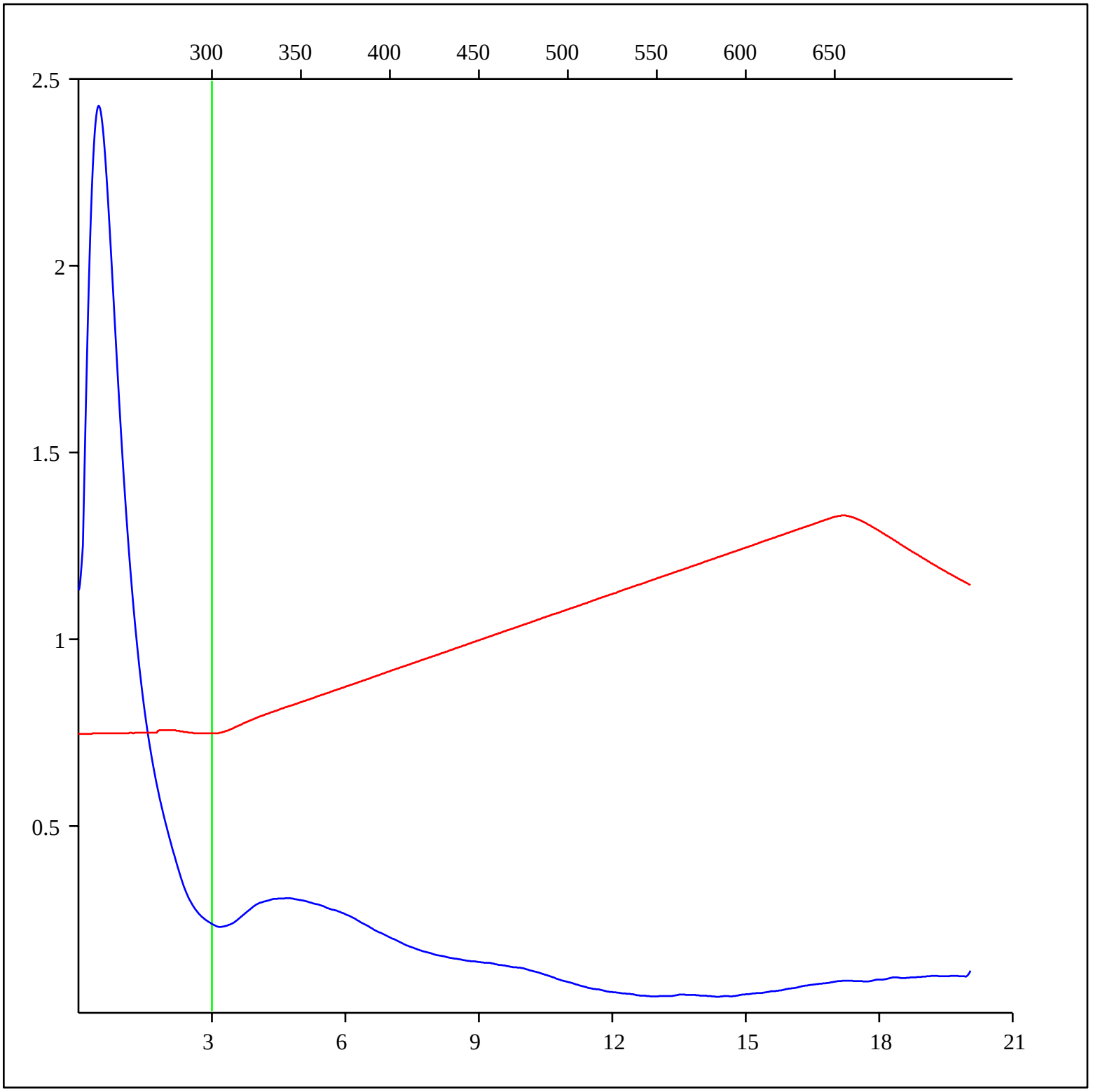
Sample: C-560363
Acquisition Date: 02-AUG-2013
Location: ROLAND BAY Y.T. L-41
Depth: 1281.4 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



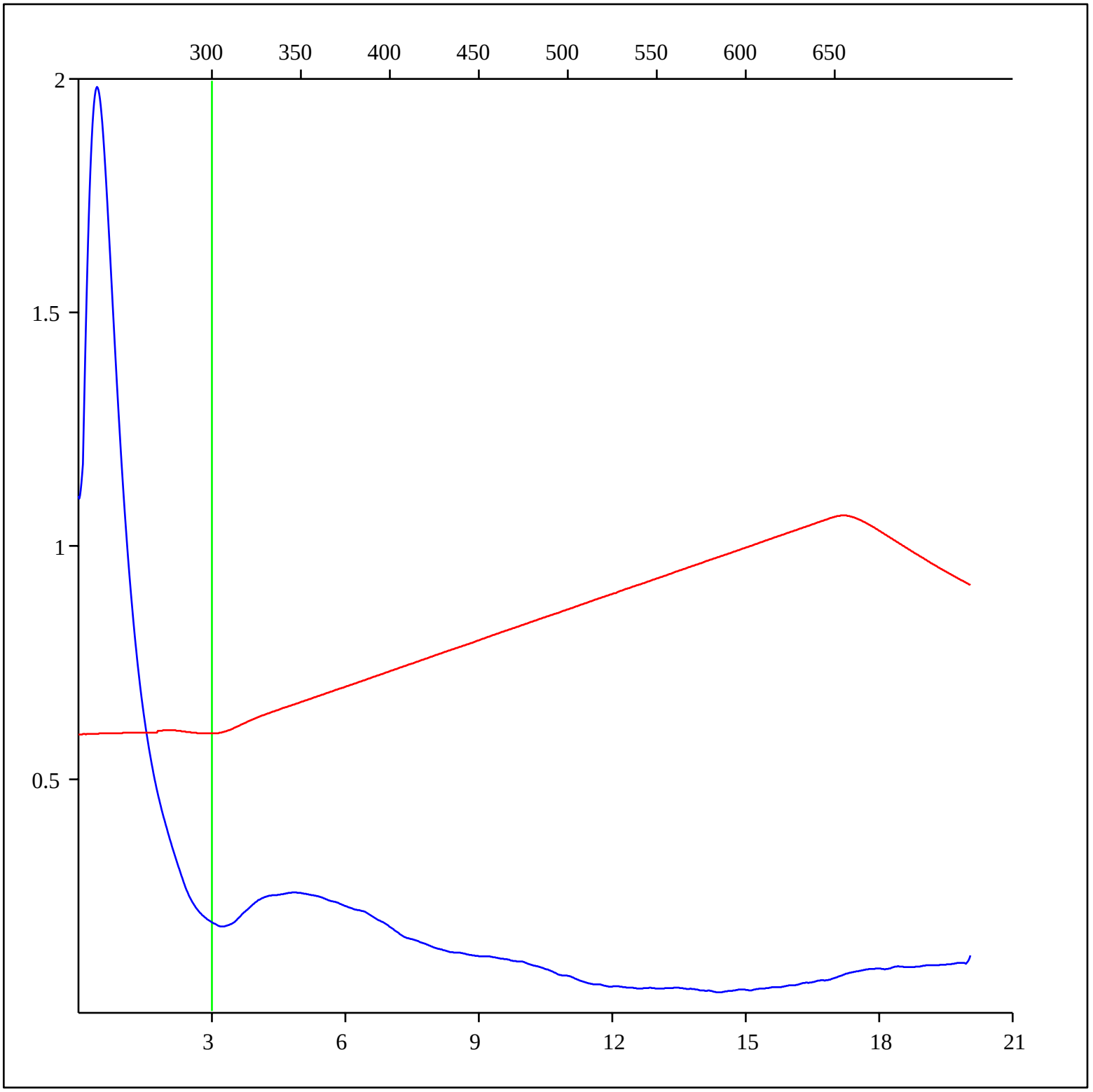
Sample: C-560364
Acquisition Date: 02-AUG-2013
Location: ROLAND BAY Y.T. L-41
Depth: 1586.42 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



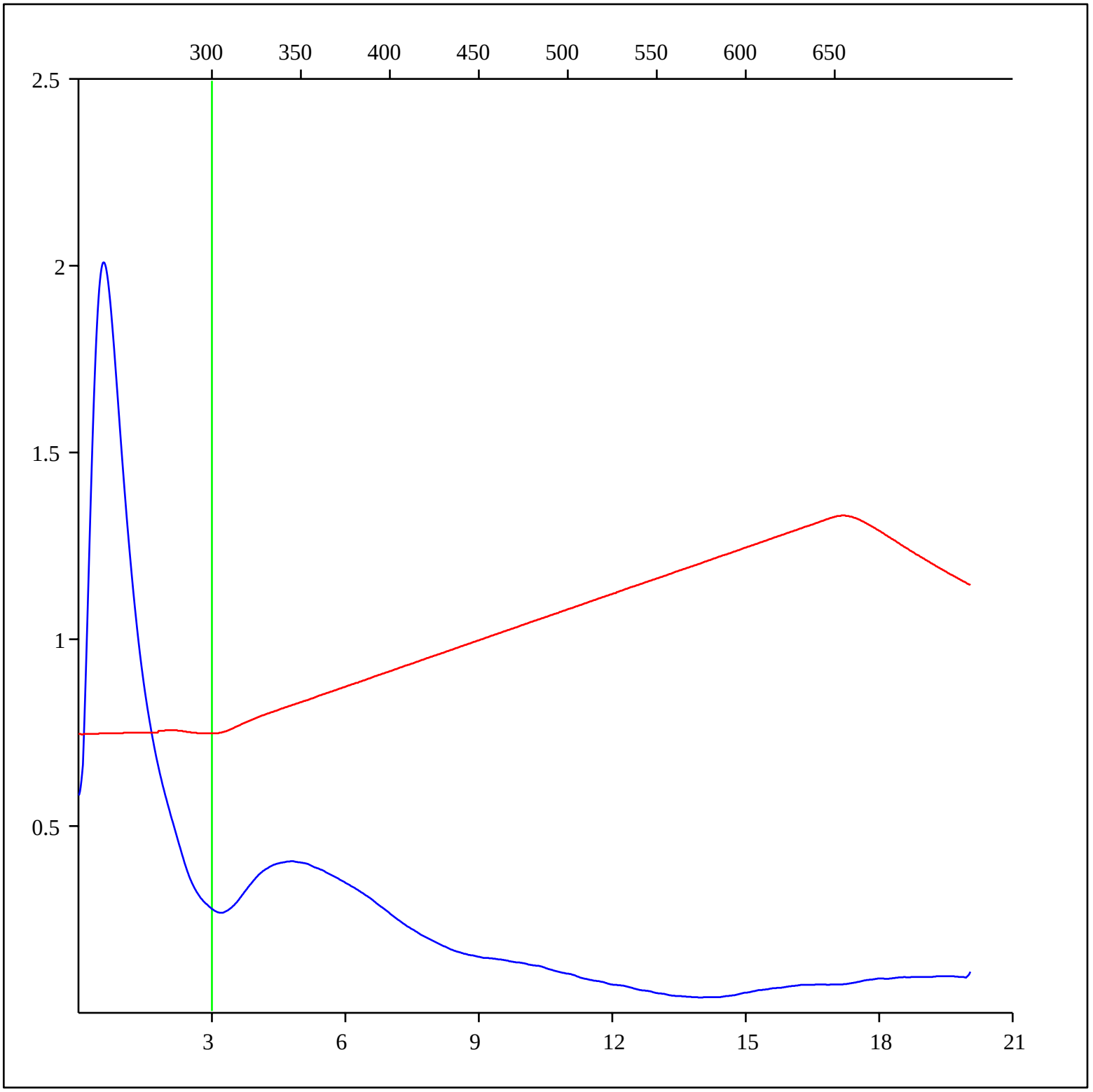
Sample: C-560364
Acquisition Date: 02-AUG-2013
Location: ROLAND BAY Y.T. L-41
Depth: 1586.42 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



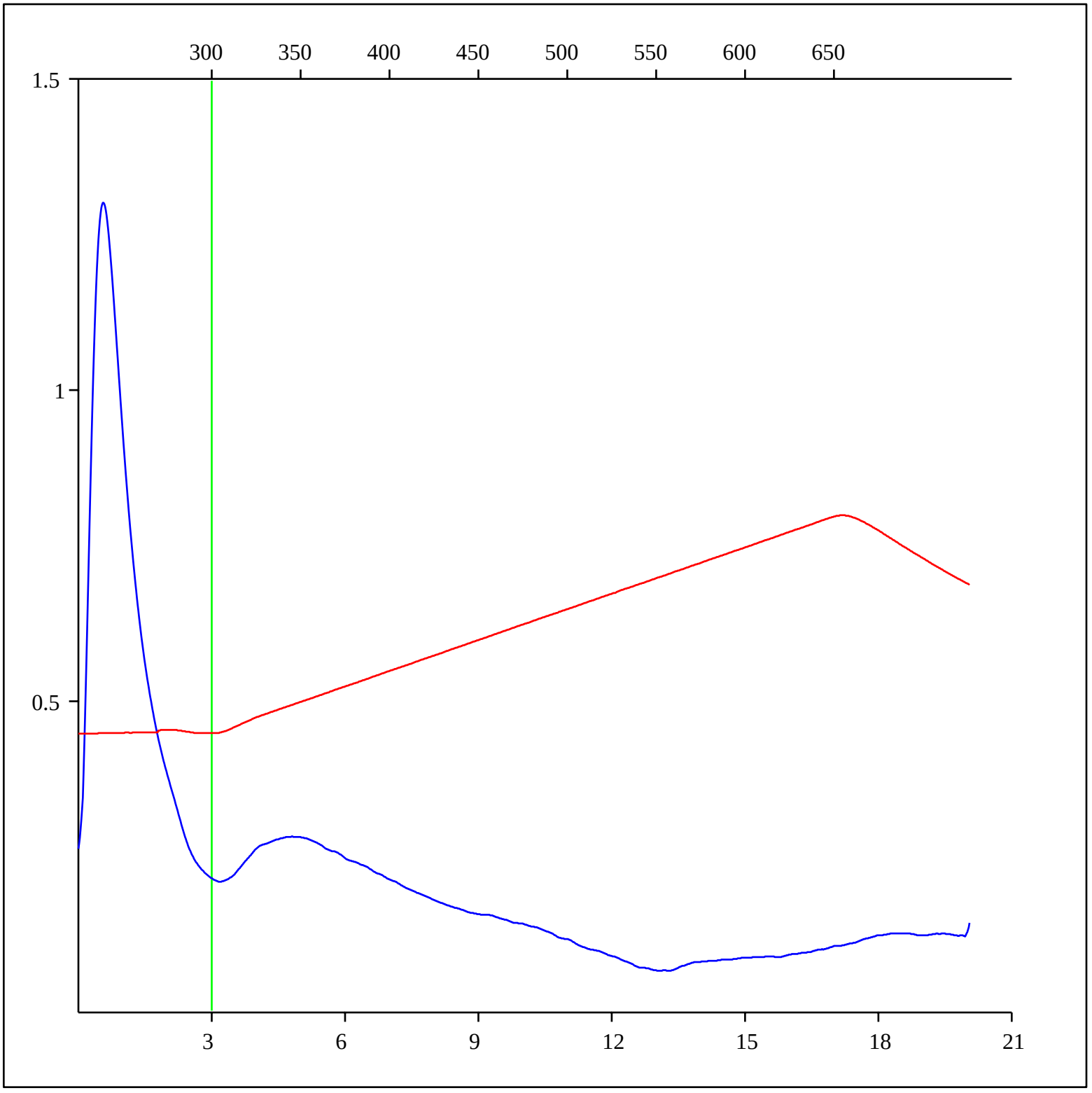
Sample: C-560365
Acquisition Date: 02-AUG-2013
Location: ROLAND BAY Y.T. L-41
Depth: 1892 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



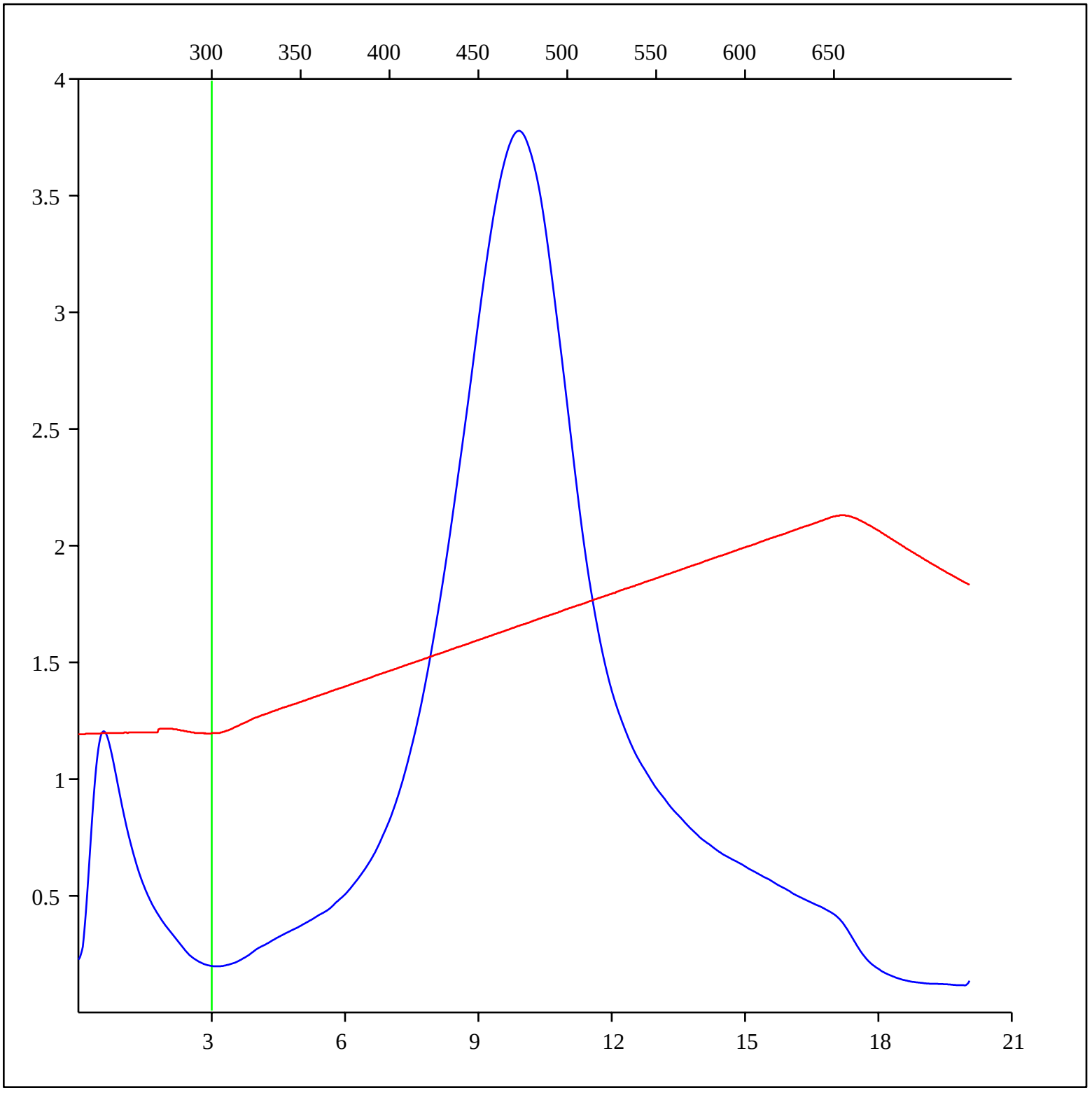
Sample: C-560366
Acquisition Date: 02-AUG-2013
Location: ROLAND BAY Y.T. L-41
Depth: 2206.16 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



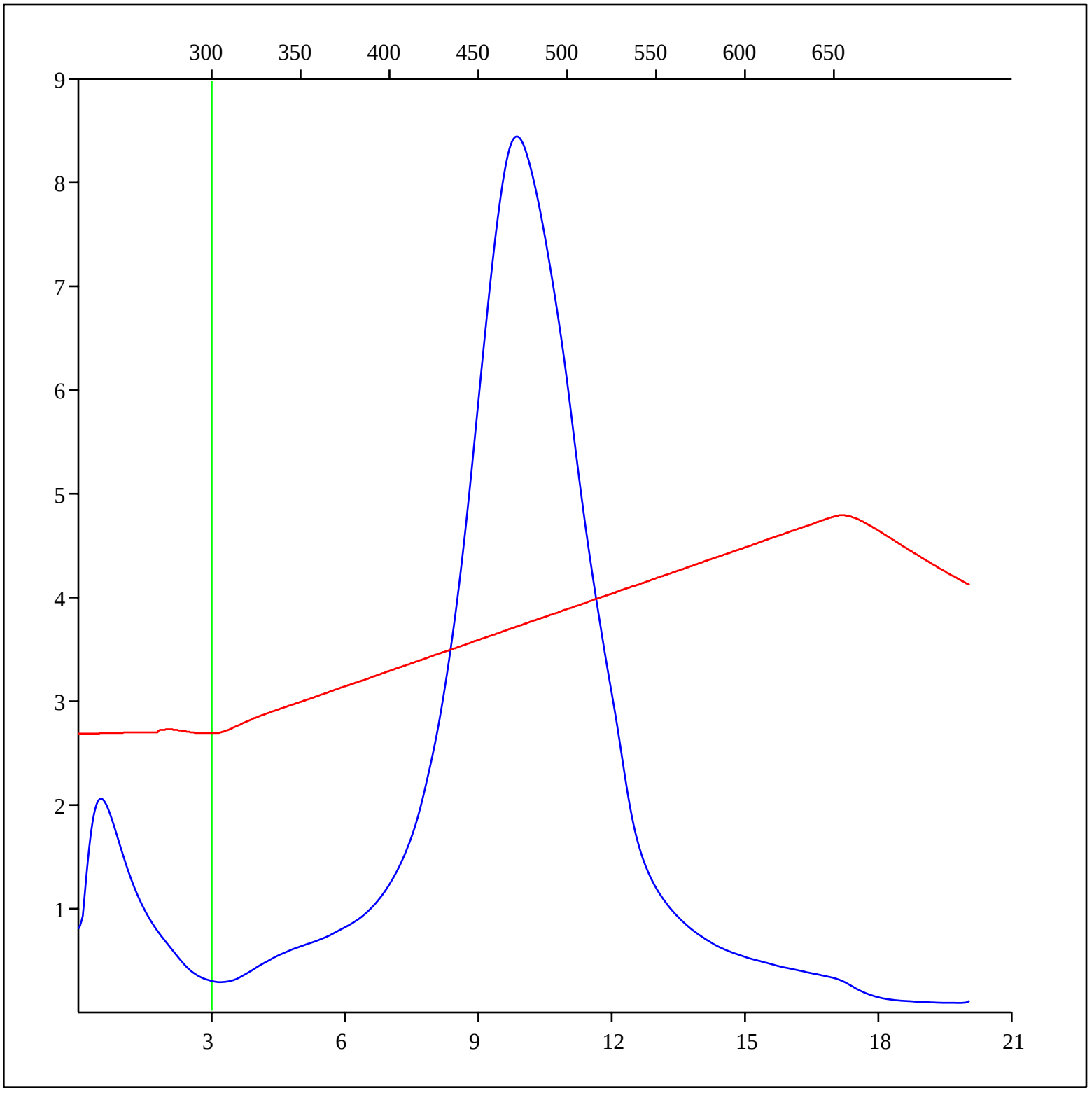
Sample: C-560367
Acquisition Date: 02-AUG-2013
Location: SARPIK B-35
Depth: 2849.37 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



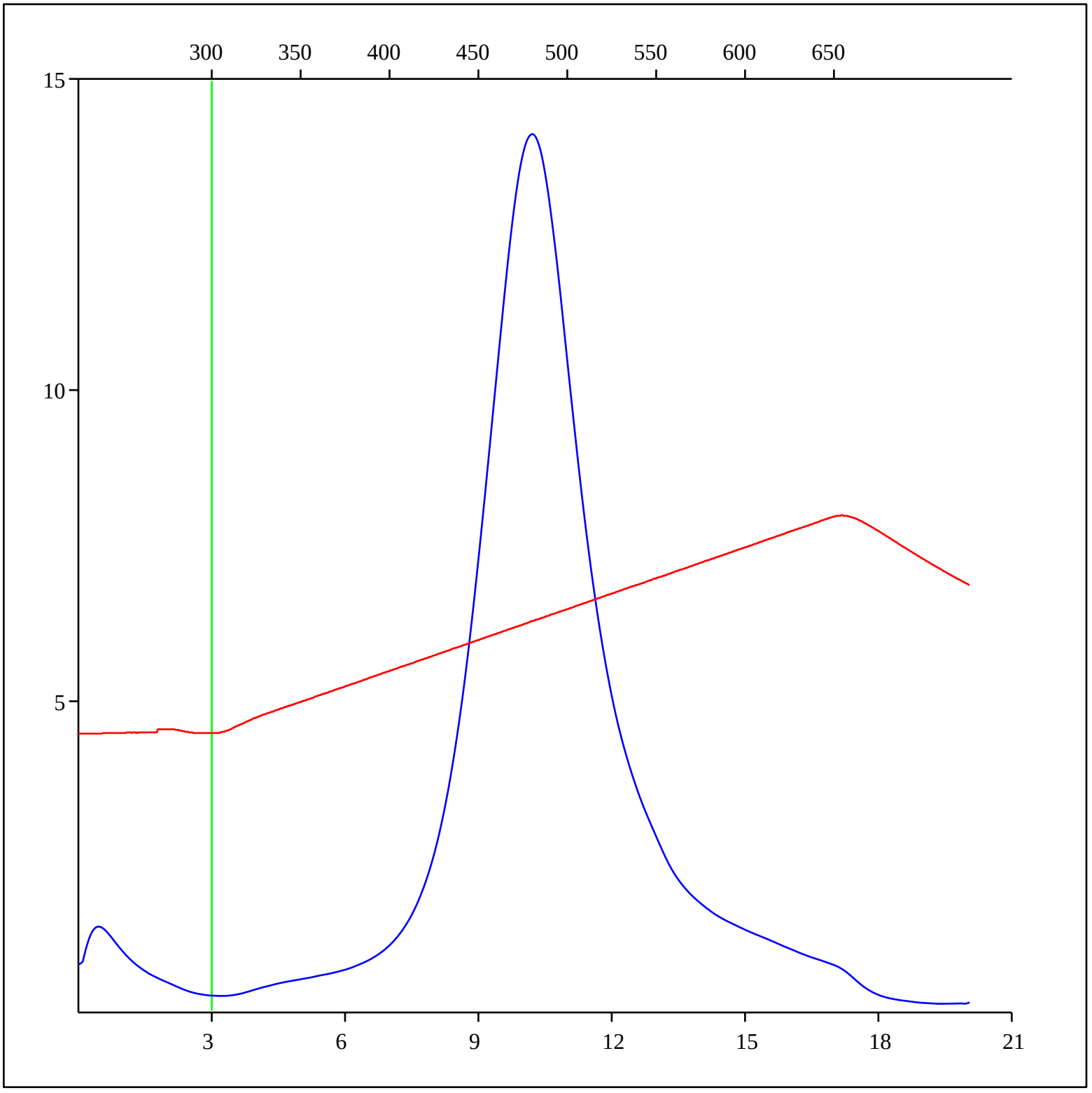
Sample: C-560368
Acquisition Date: 02-AUG-2013
Location: SIKU E-21
Depth: 2865.83 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



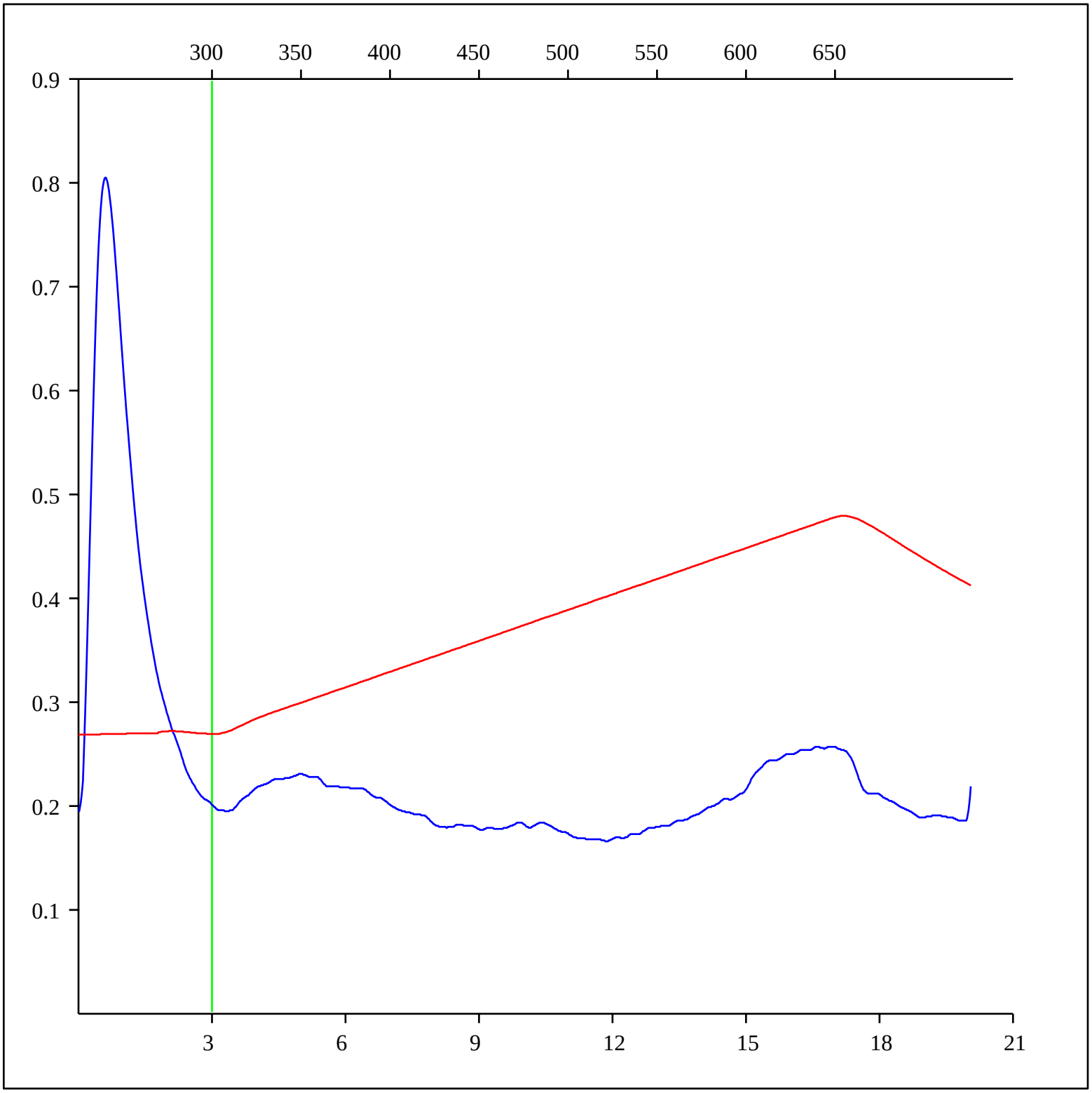
Sample: C-560369
Acquisition Date: 02-AUG-2013
Location: SIKU E-21
Depth: 3047.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



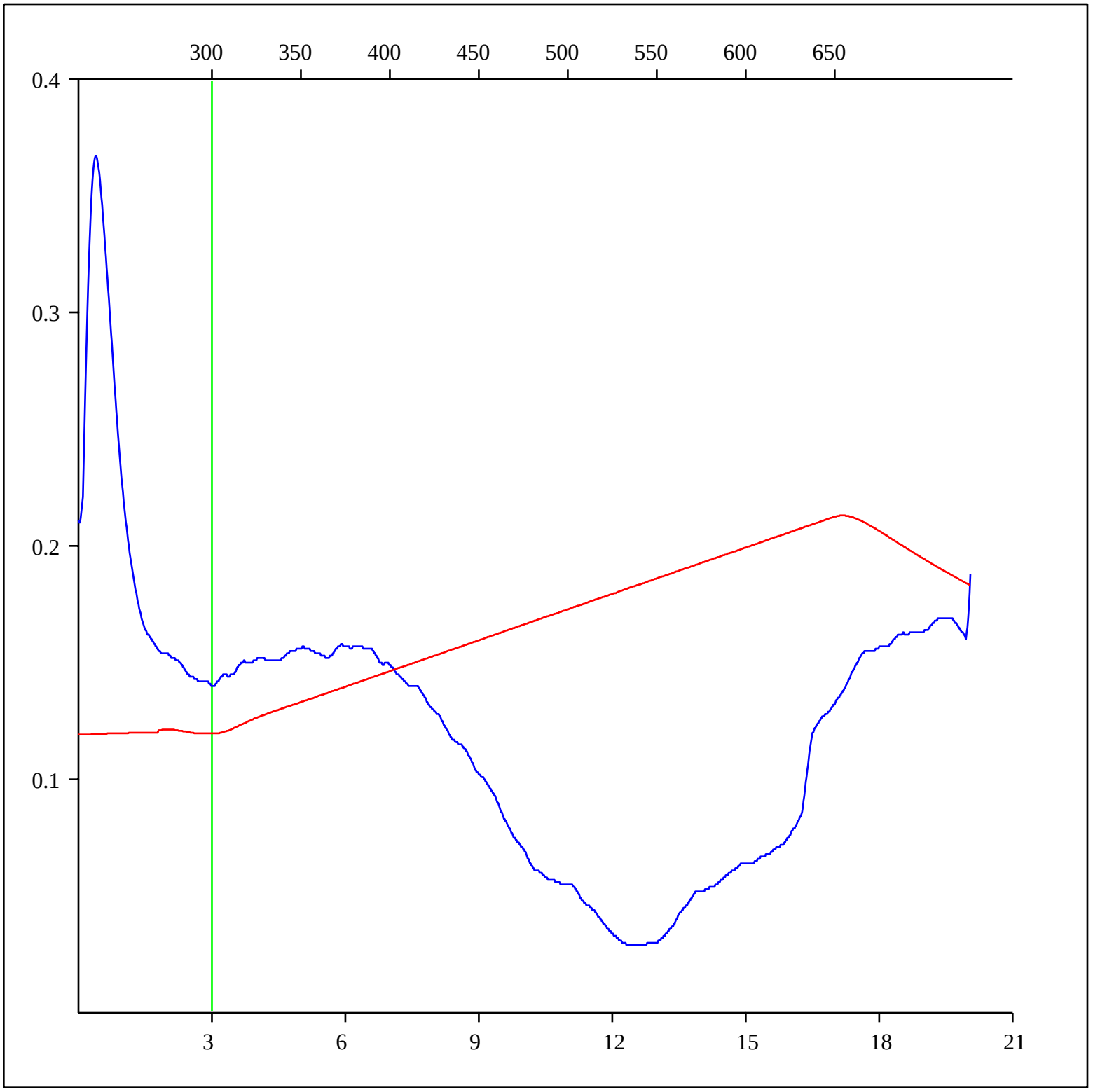
Sample: C-560370
Acquisition Date: 02-AUG-2013
Location: SPRING RIVER YT N-58
Depth: 600.7 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



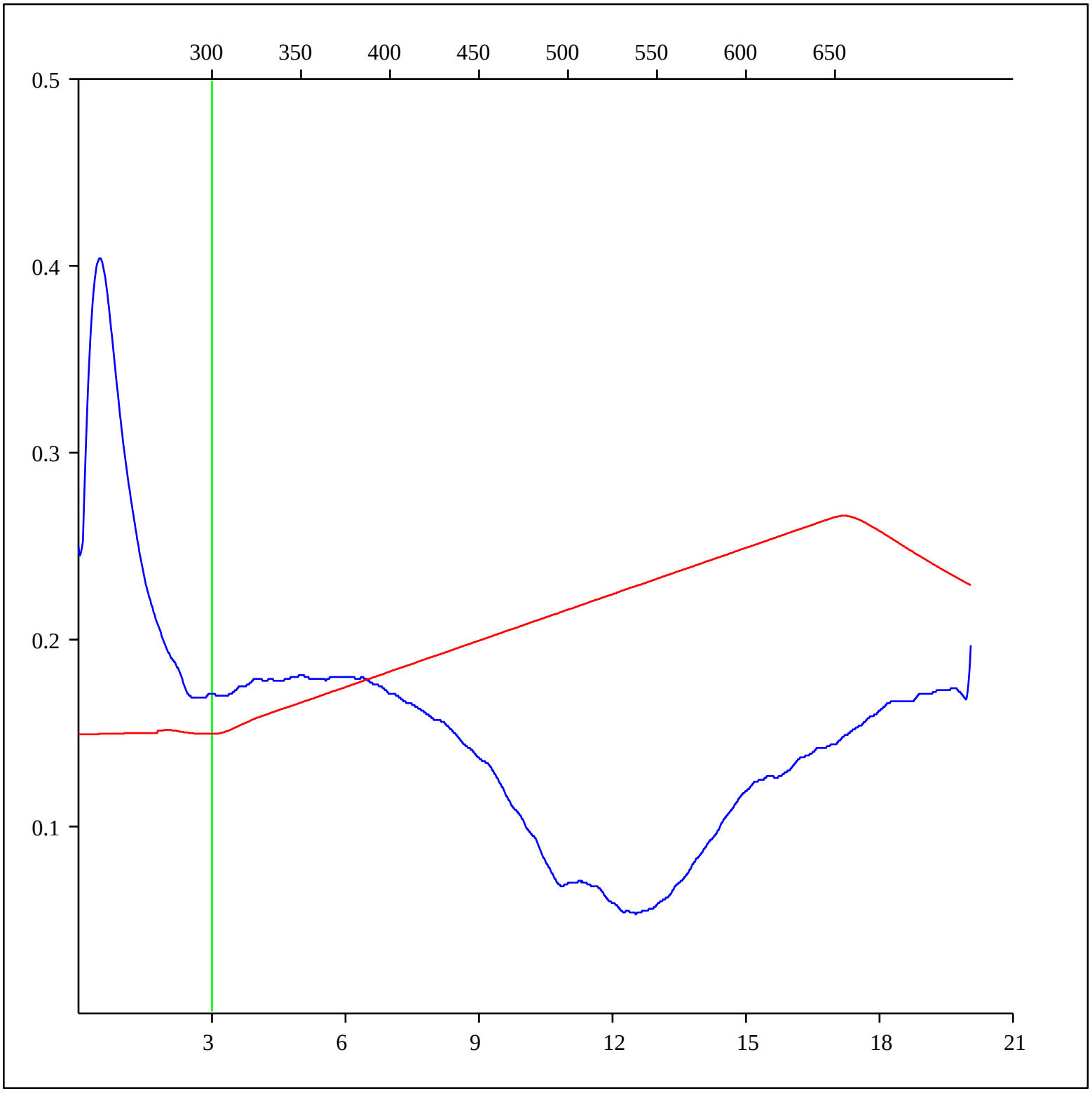
Sample: C-560371
Acquisition Date: 02-AUG-2013
Location: SPRING RIVER YT N-58
Depth: 1343.02 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



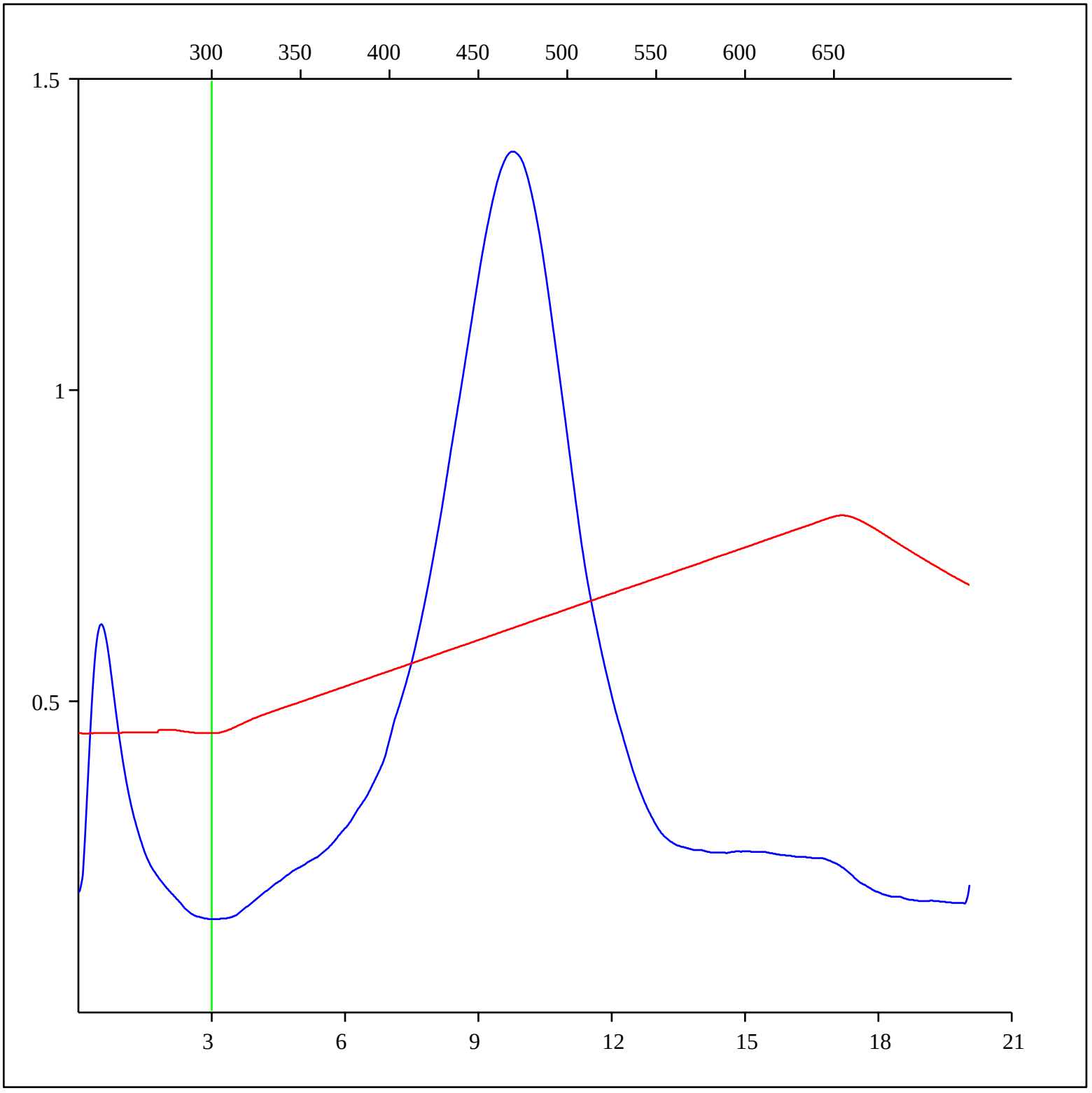
Sample: C-560372
Acquisition Date: 02-AUG-2013
Location: SPRING RIVER YT N-58
Depth: 1649.32 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



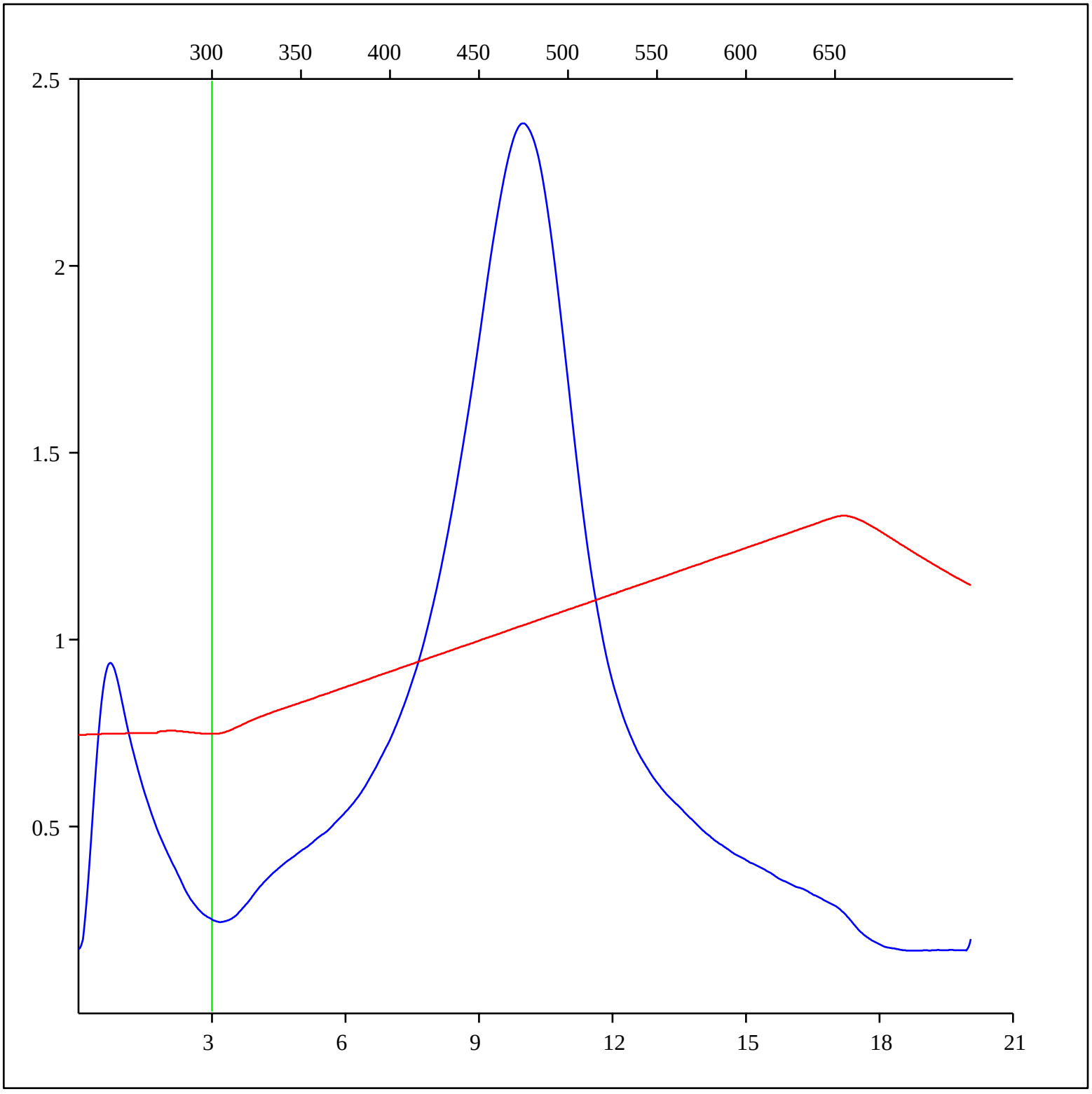
Sample: C-560373
Acquisition Date: 02-AUG-2013
Location: TAGLU D-55
Depth: 2903.6 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



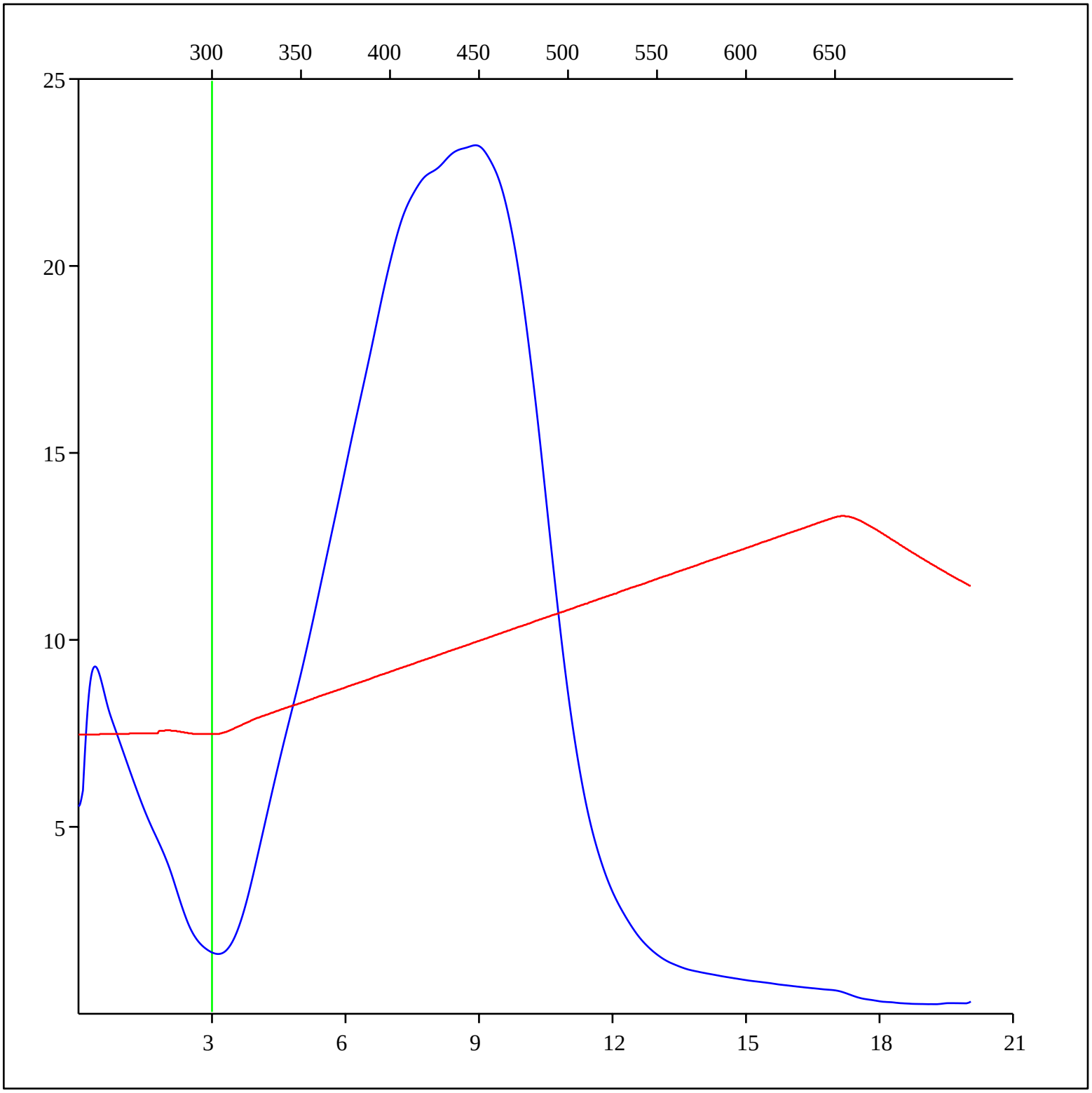
Sample: C-560374
Acquisition Date: 02-AUG-2013
Location: TAGLU D-55
Depth: 3210.2 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



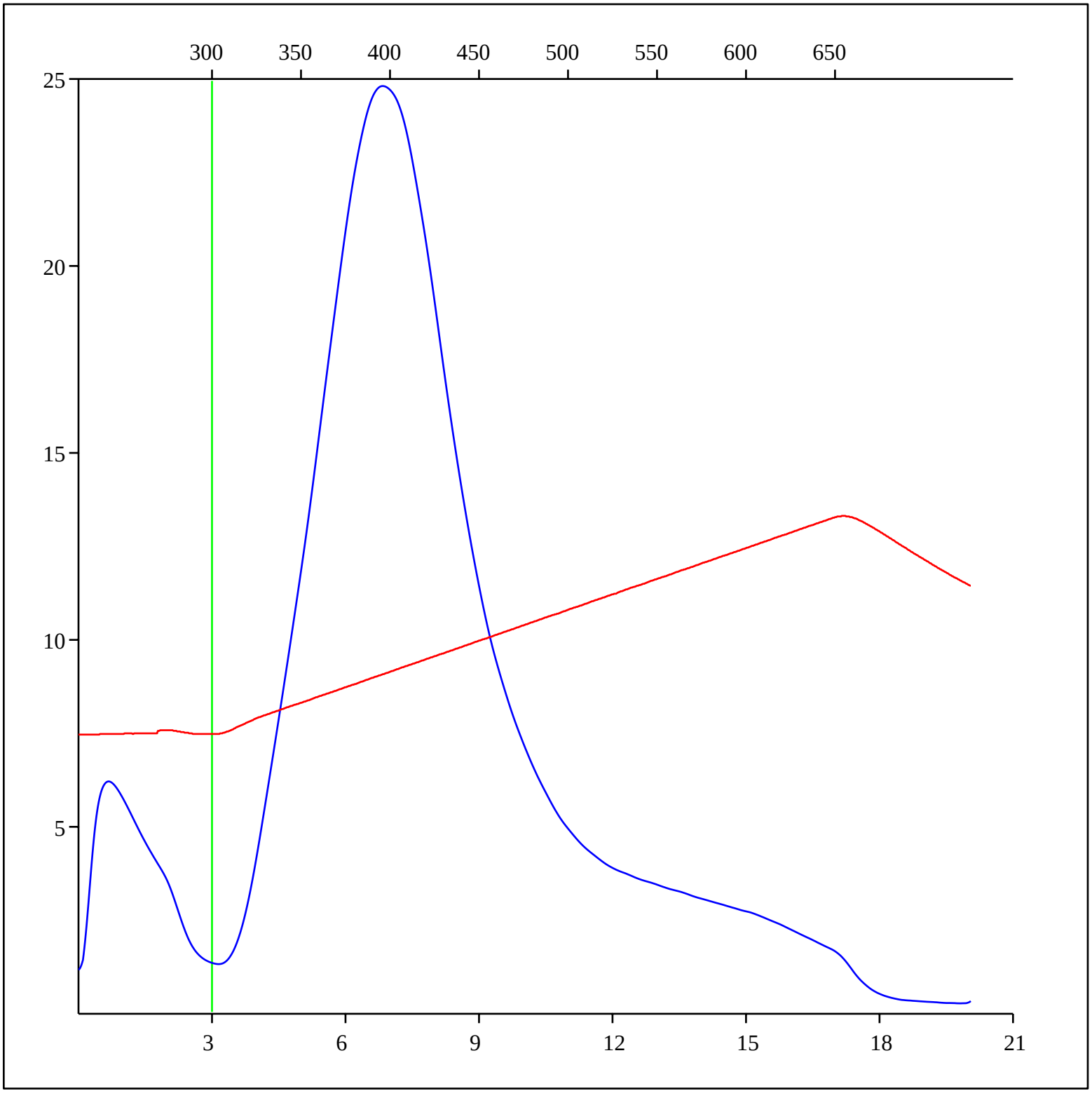
Sample: C-560375
Acquisition Date: 02-AUG-2013
Location: TAGLU G-33
Depth: 952.1 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



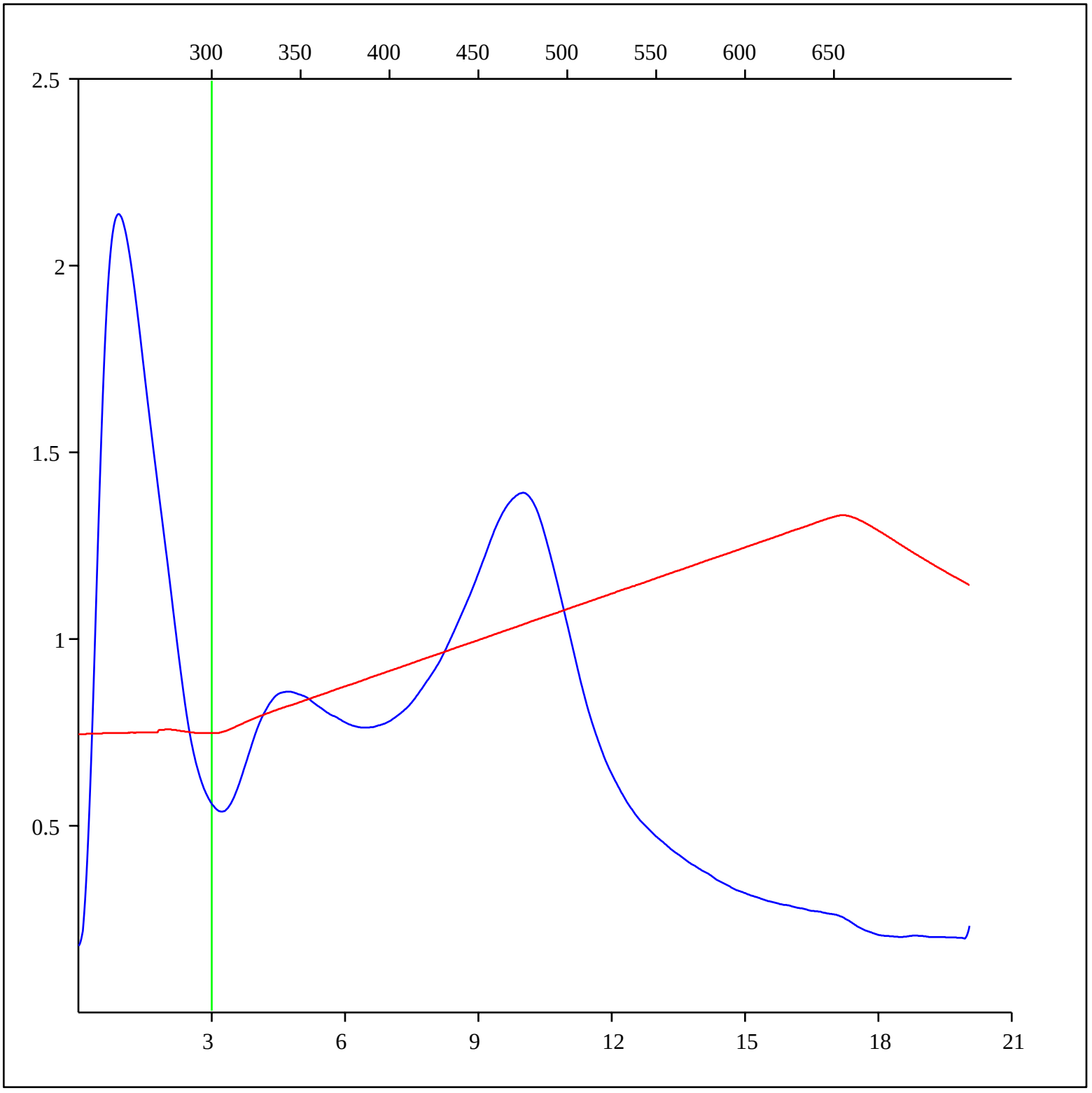
Sample: C-560376
Acquisition Date: 02-AUG-2013
Location: TAGLU G-33
Depth: 951.3 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



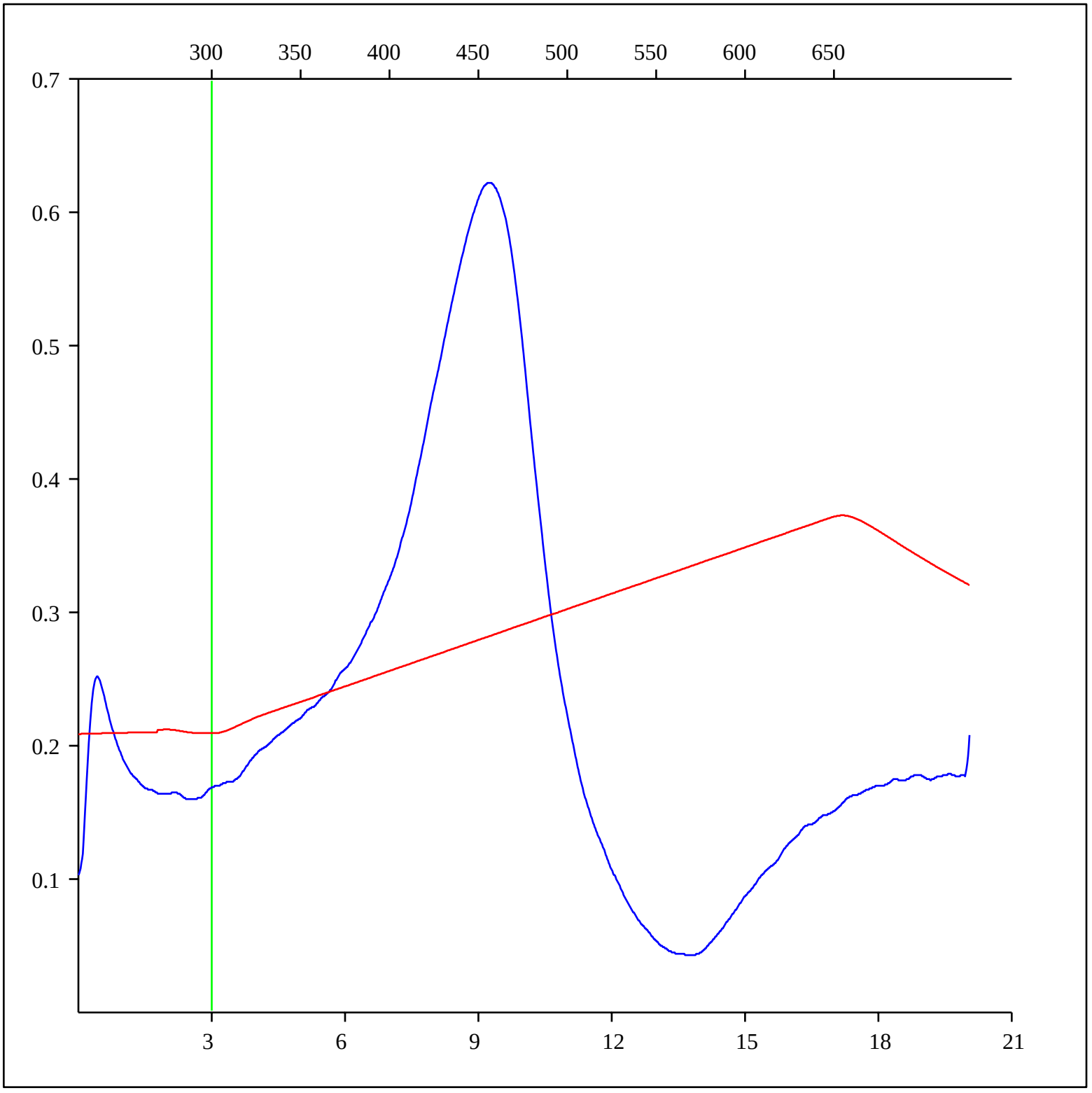
Sample: C-560377
Acquisition Date: 02-AUG-2013
Location: TAGLU G-33
Depth: 2074.14 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



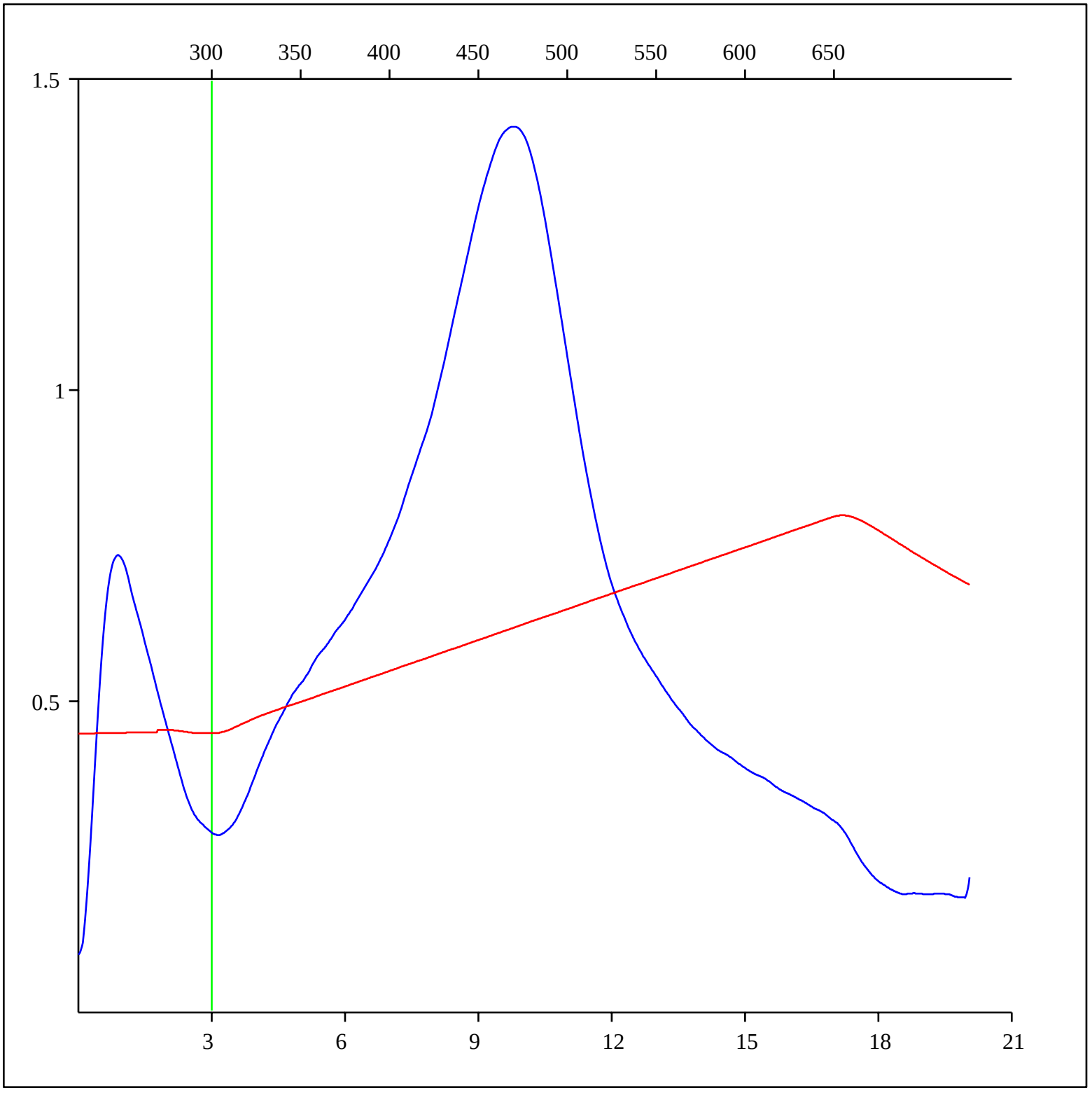
Sample: C-560378
Acquisition Date: 02-AUG-2013
Location: TAGLU G-33
Depth: 2461.7 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



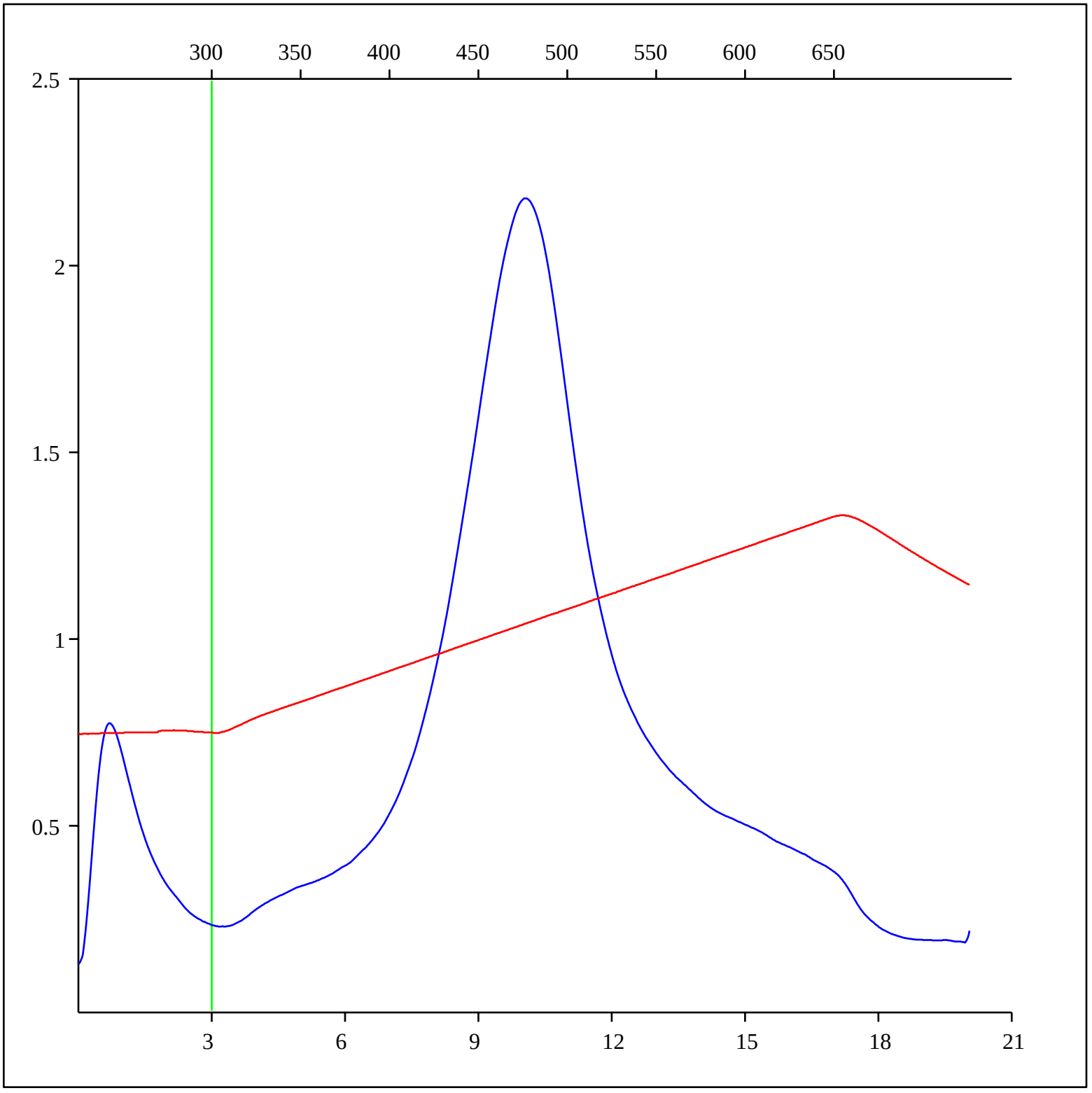
Sample: C-560379
Acquisition Date: 02-AUG-2013
Location: TAGLU G-33
Depth: 2601.8 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



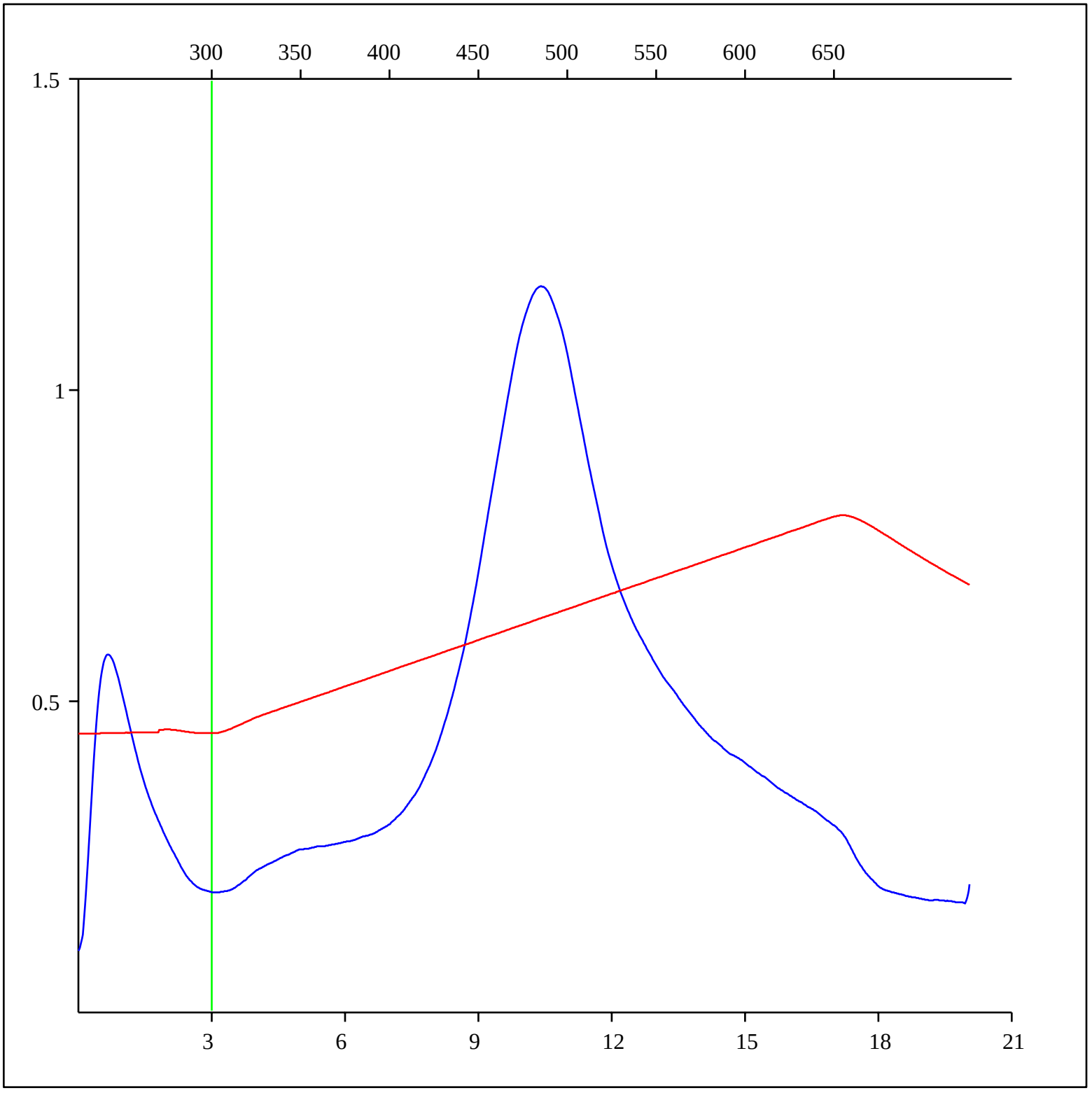
Sample: C-560380
Acquisition Date: 02-AUG-2013
Location: TITALIK O-15
Depth: 1908.62 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



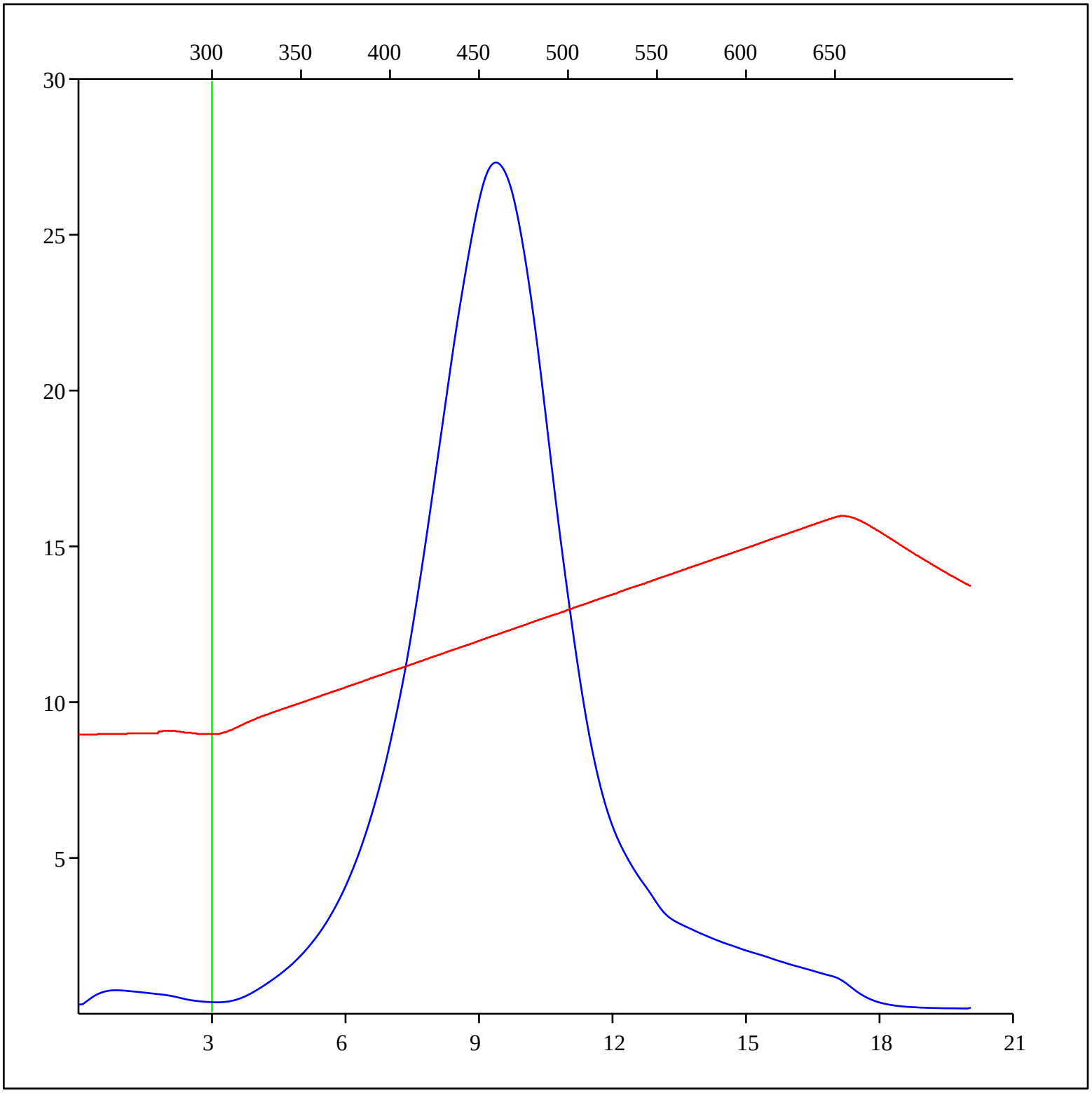
Sample: C-560381
Acquisition Date: 02-AUG-2013
Location: TITALIK O-15
Depth: 2824.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



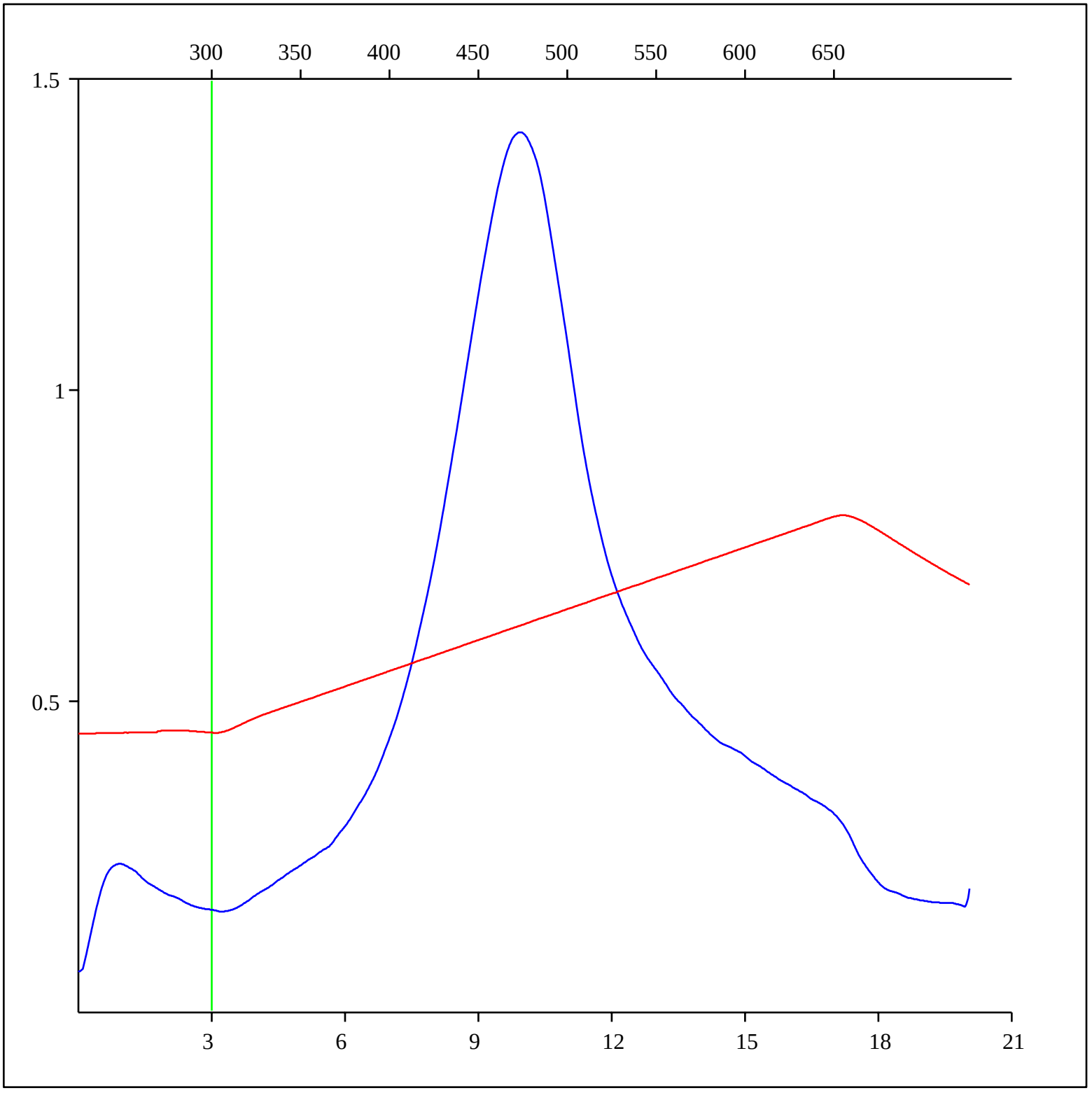
Sample: C-560382
Acquisition Date: 02-AUG-2013
Location: TOAPOLOK H-24
Depth: 1643.3 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



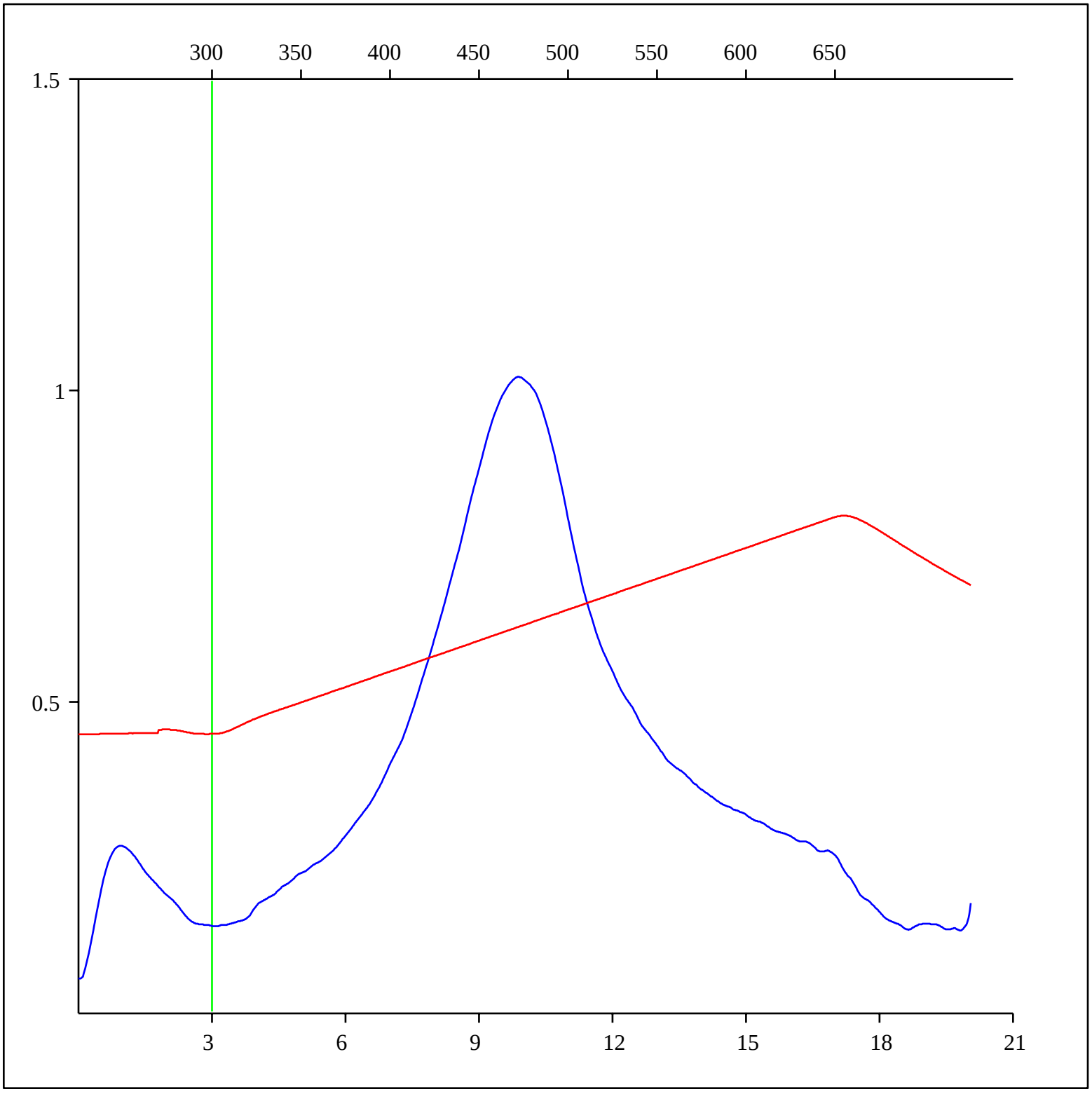
Sample: C-560383
Acquisition Date: 02-AUG-2013
Location: TOAPOLOK H-24
Depth: 2148.75 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



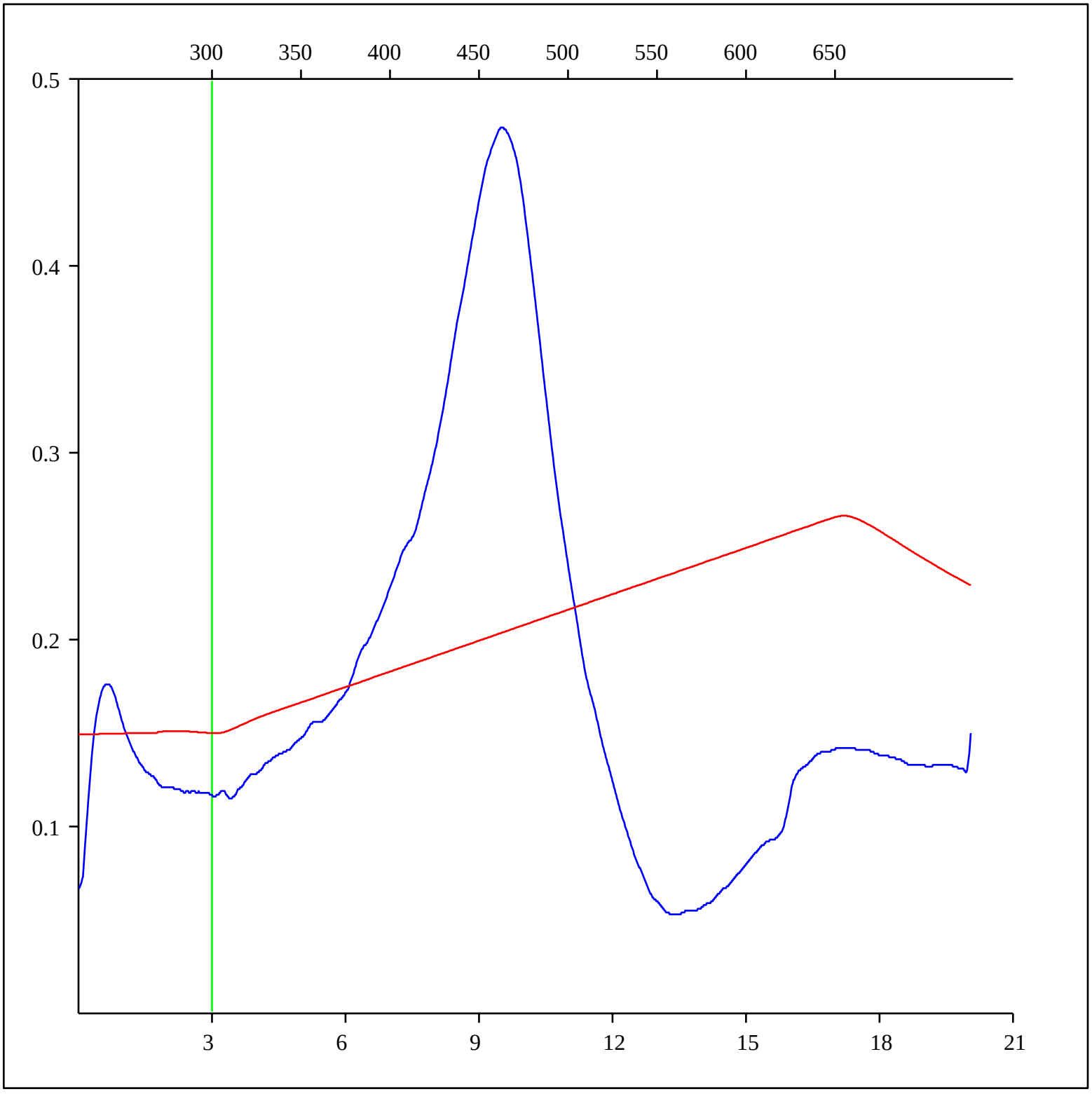
Sample: C-560384
Acquisition Date: 02-AUG-2013
Location: TUK F-18
Depth: 1729.3 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



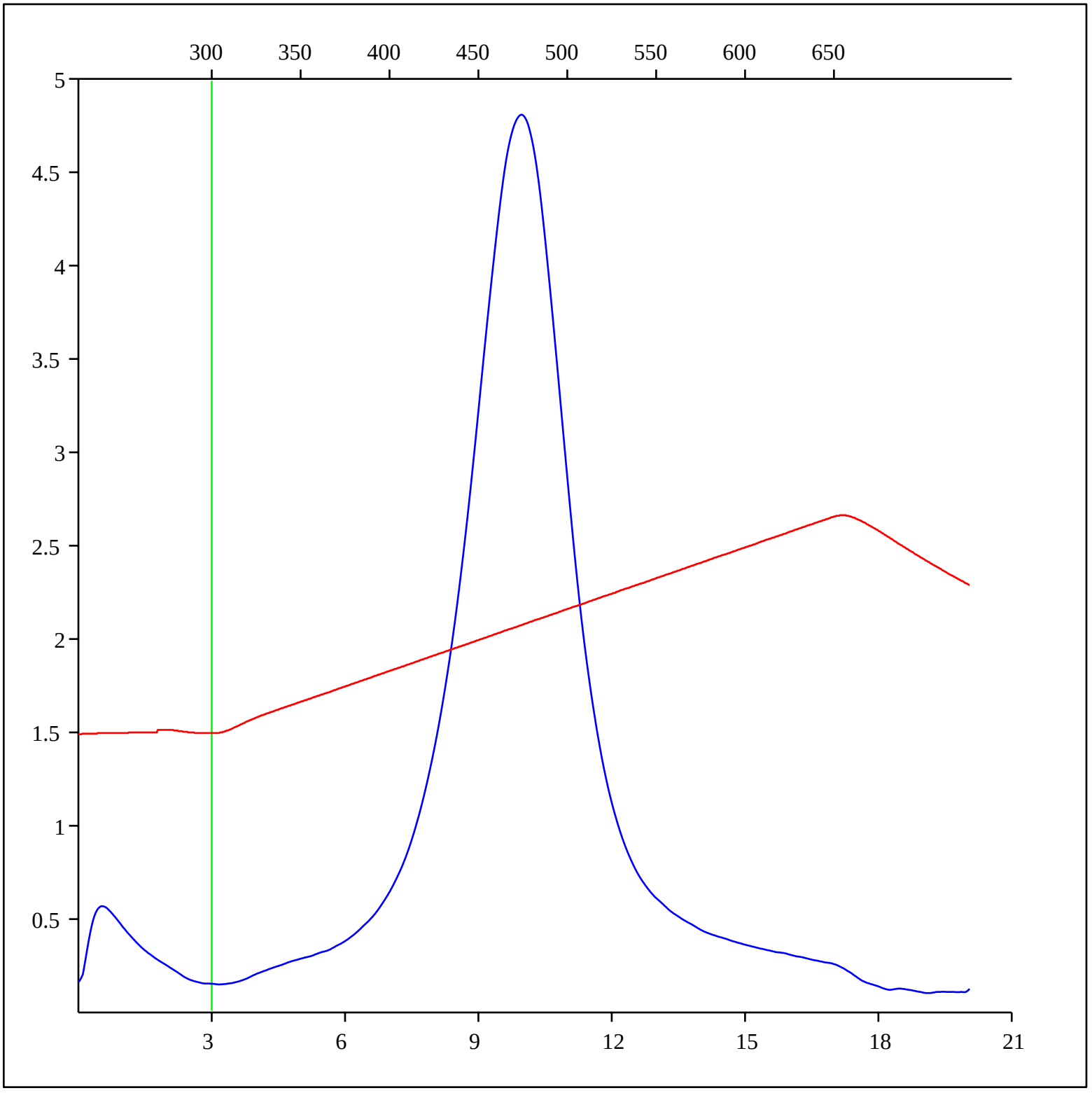
Sample: C-560385
Acquisition Date: 02-AUG-2013
Location: TUK F-18
Depth: 2182.8 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



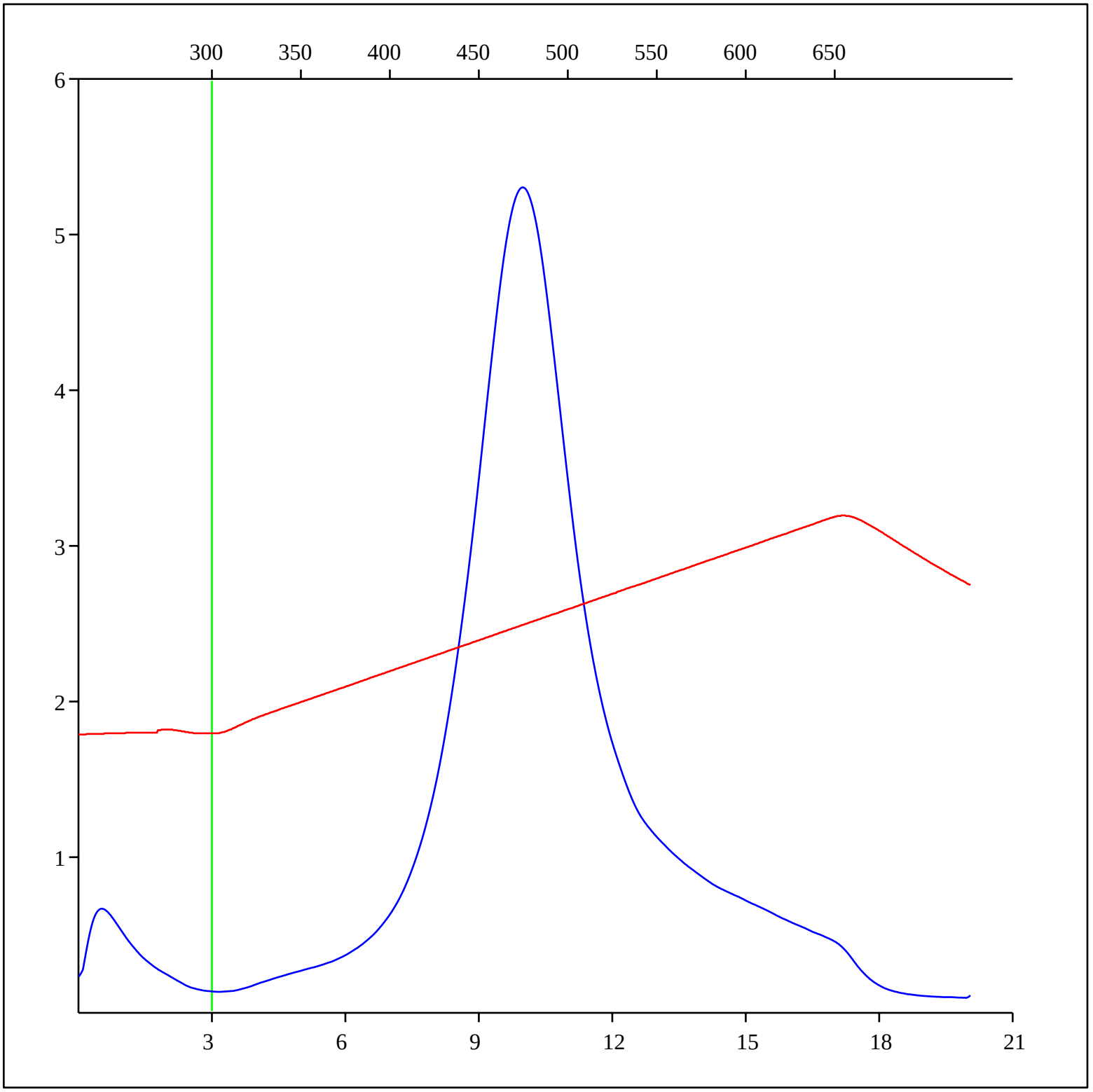
Sample: C-560386
Acquisition Date: 02-AUG-2013
Location: TUK F-18
Depth: 2457.3 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



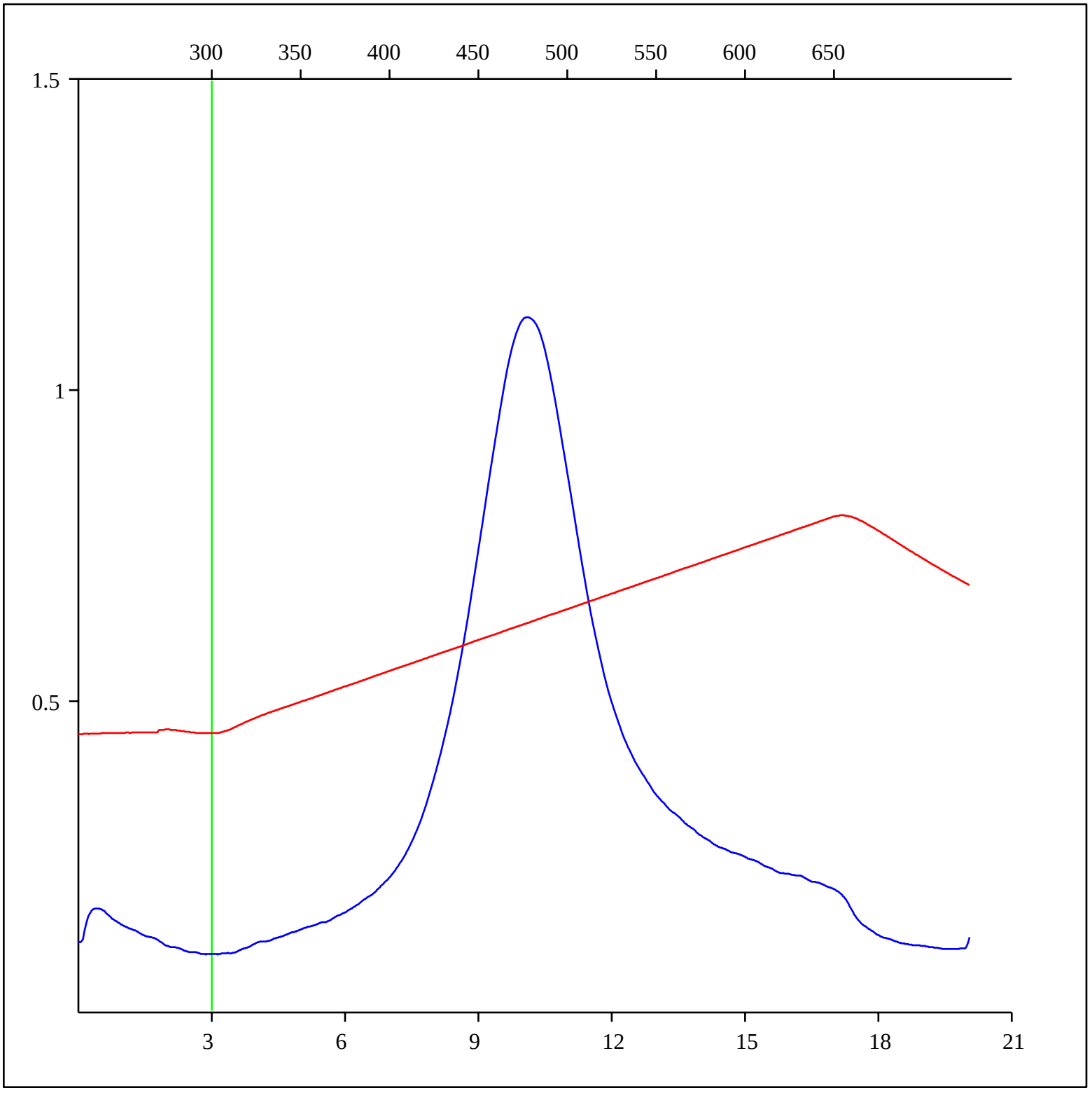
Sample: C-560387
Acquisition Date: 02-AUG-2013
Location: TUK F-18
Depth: 2789.4 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



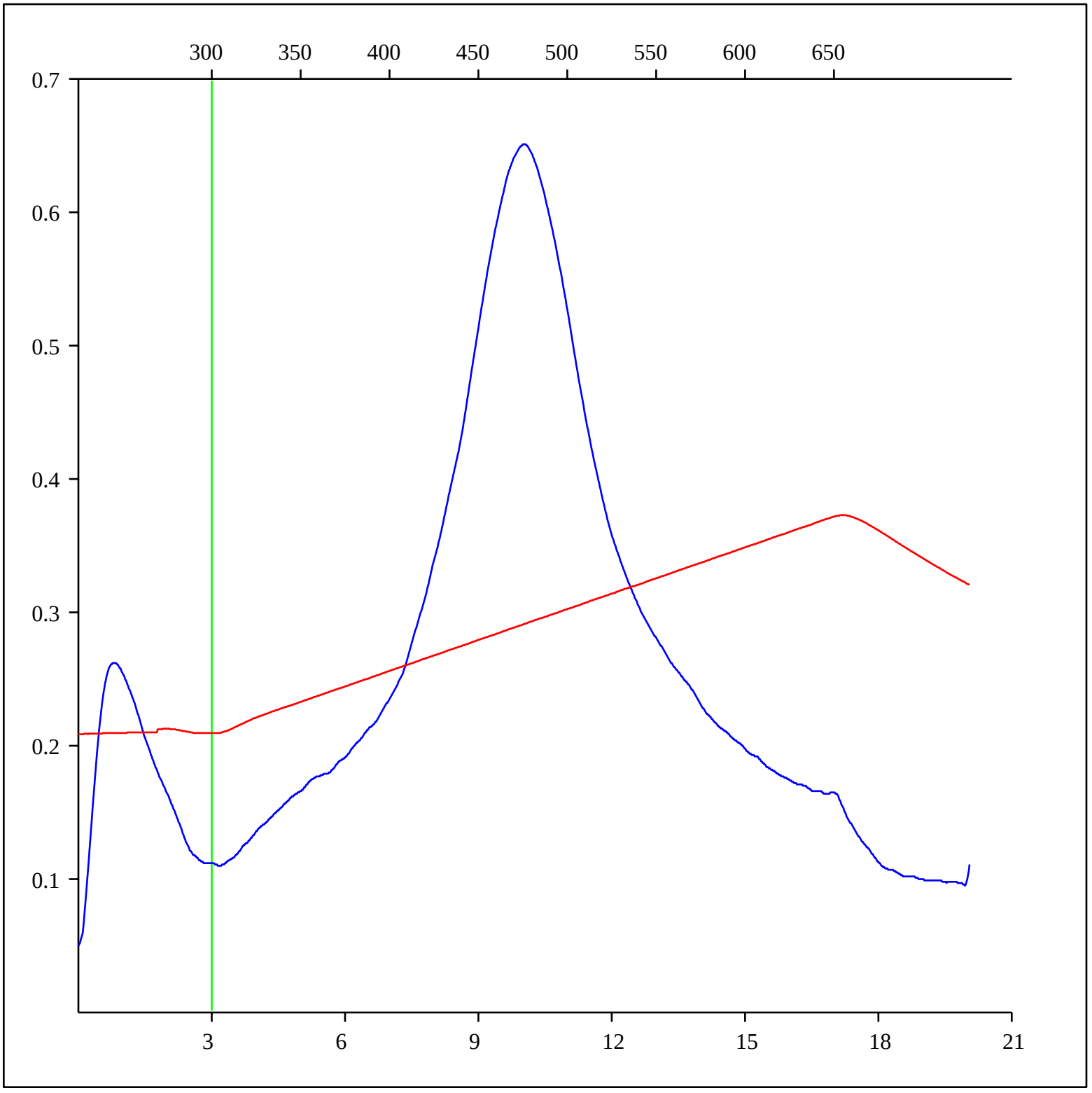
Sample: C-560388
Acquisition Date: 02-AUG-2013
Location: TUK F-18
Depth: 2884.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



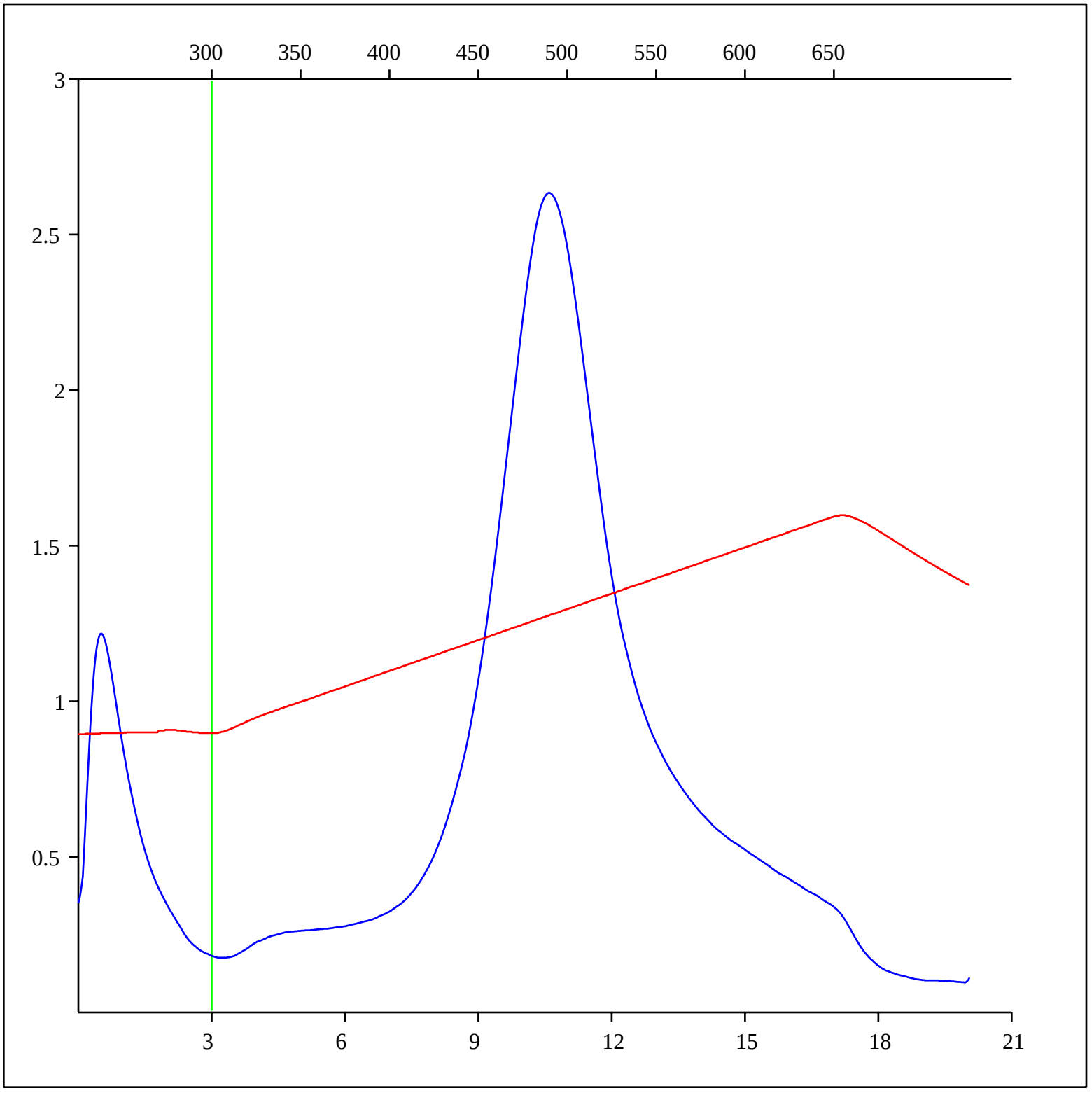
Sample: C-560389
Acquisition Date: 02-AUG-2013
Location: TUNUNUK K-10
Depth: 898.53 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



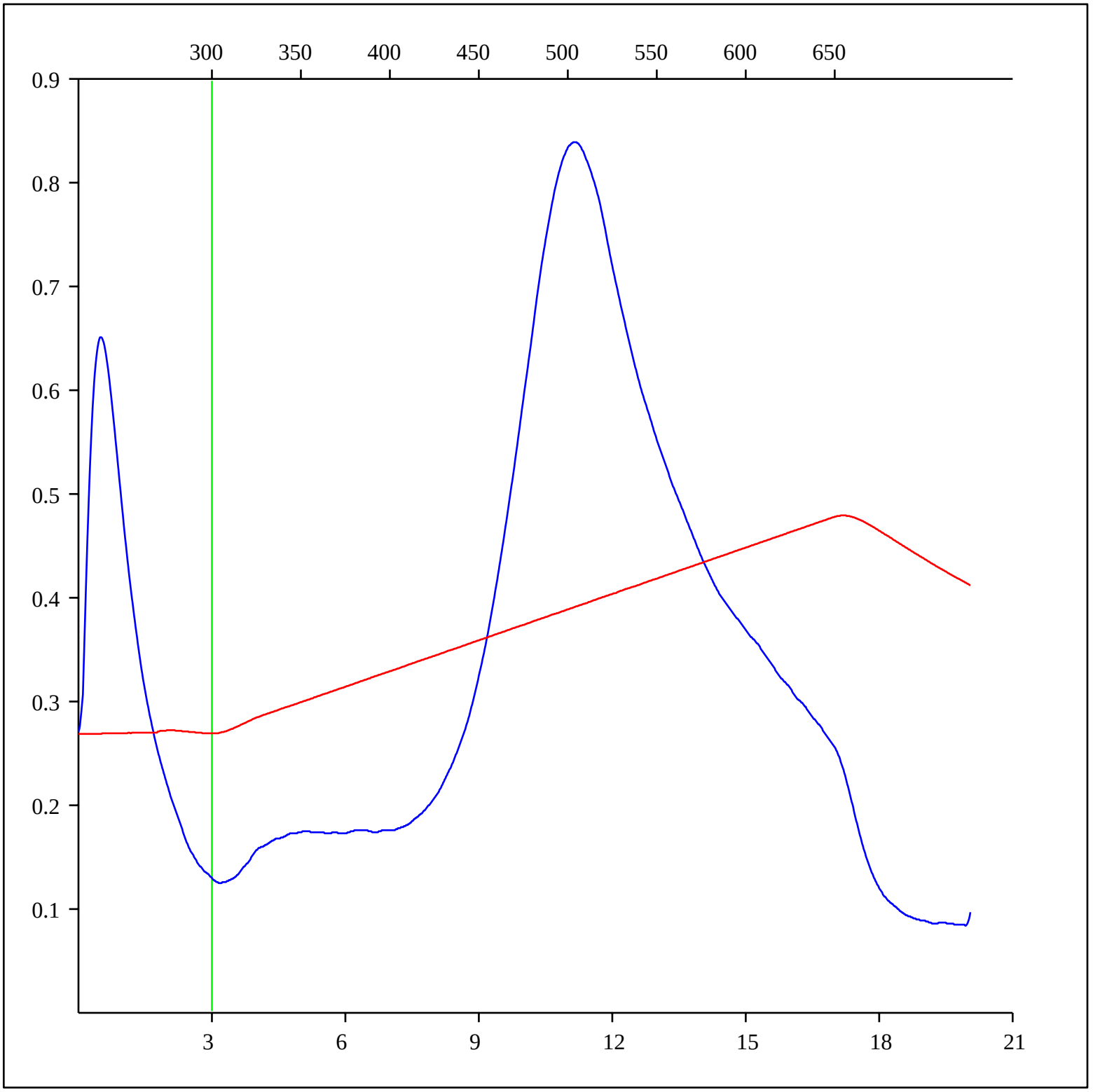
Sample: C-560390
Acquisition Date: 02-AUG-2013
Location: TUNUNUK K-10
Depth: 2824.42 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



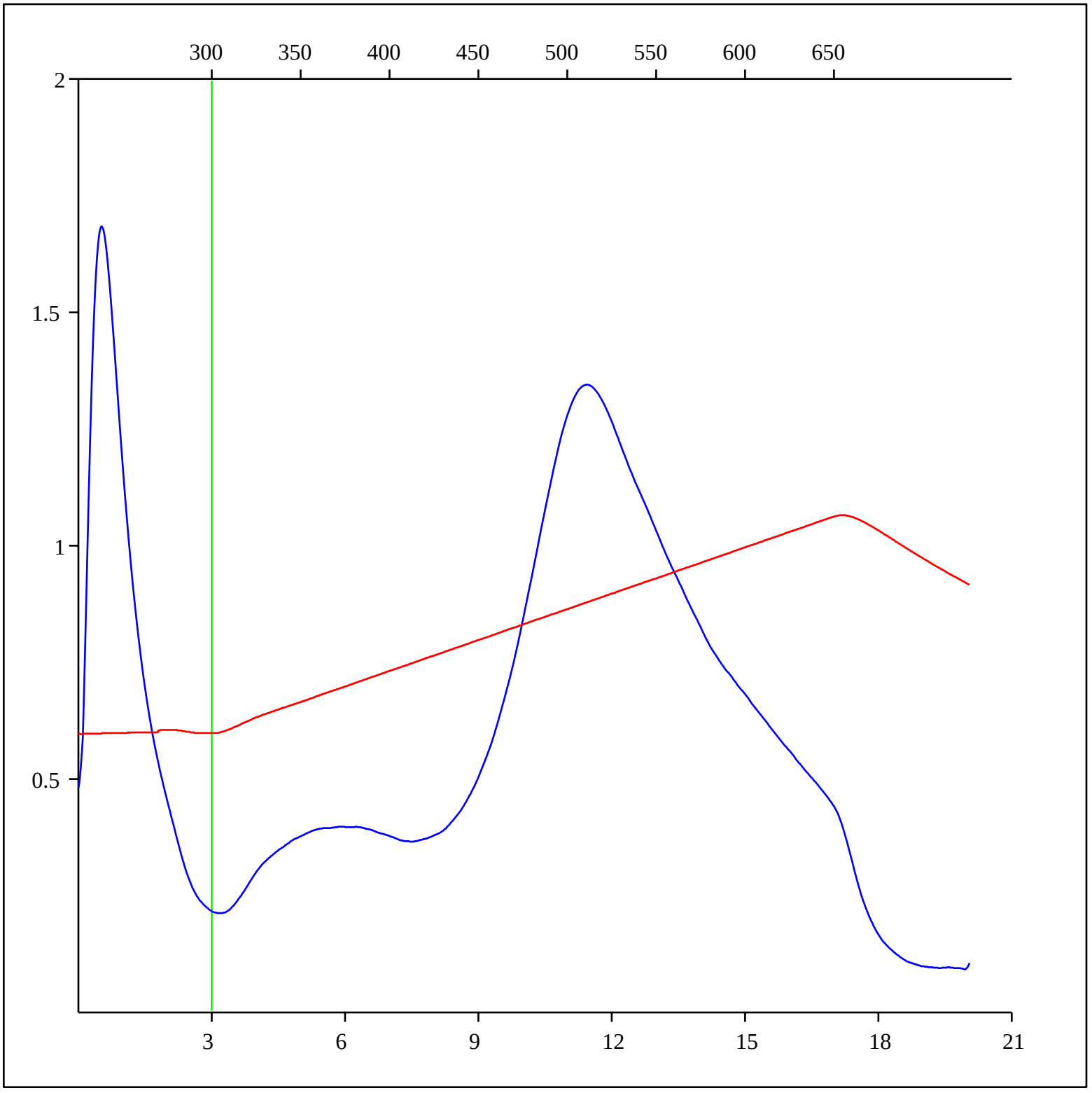
Sample: C-560391
Acquisition Date: 02-AUG-2013
Location: TUNUNUK K-10
Depth: 3357.6 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



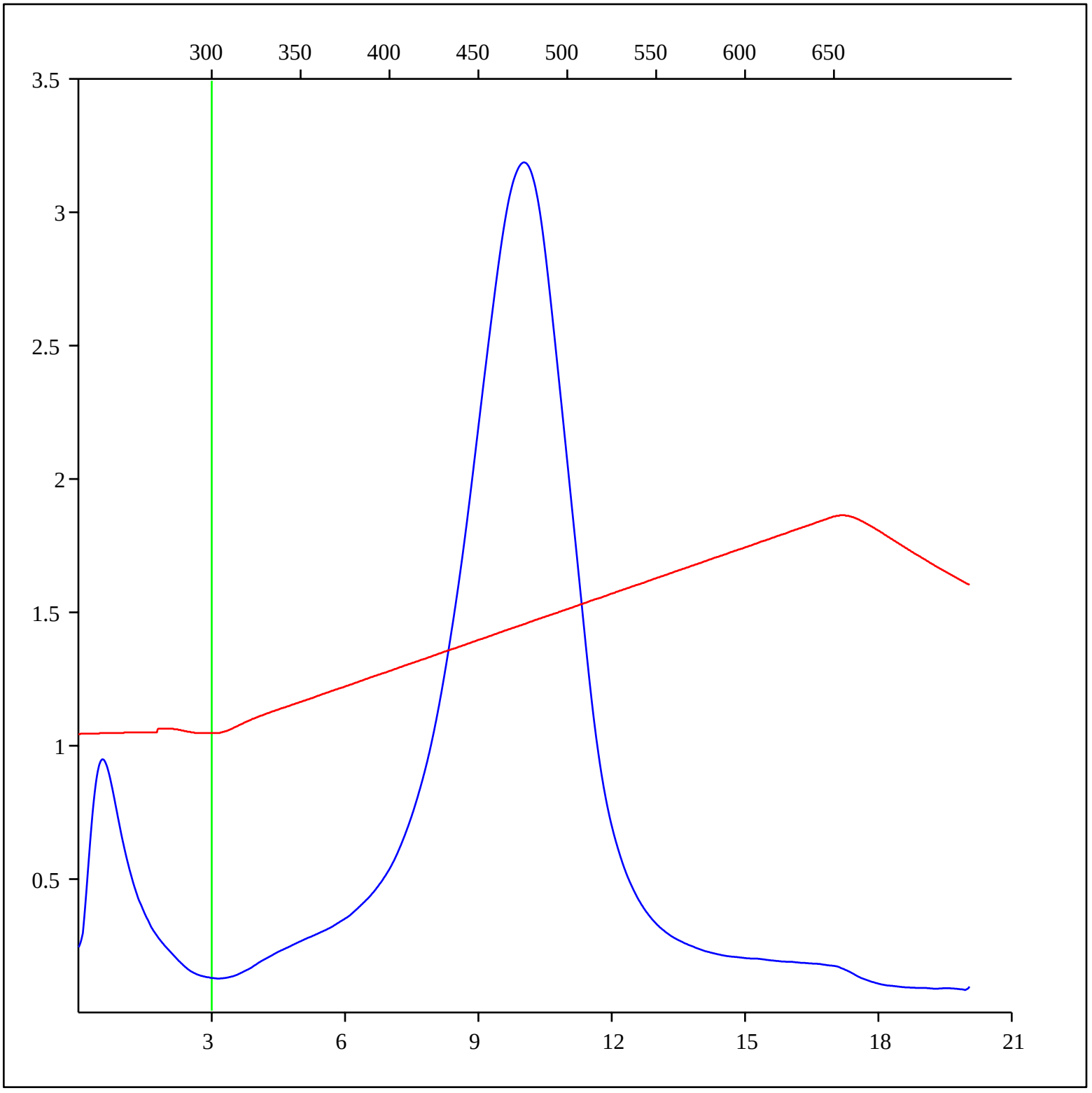
Sample: C-560392
Acquisition Date: 02-AUG-2013
Location: TUNUNUK K-10
Depth: 3708.5 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



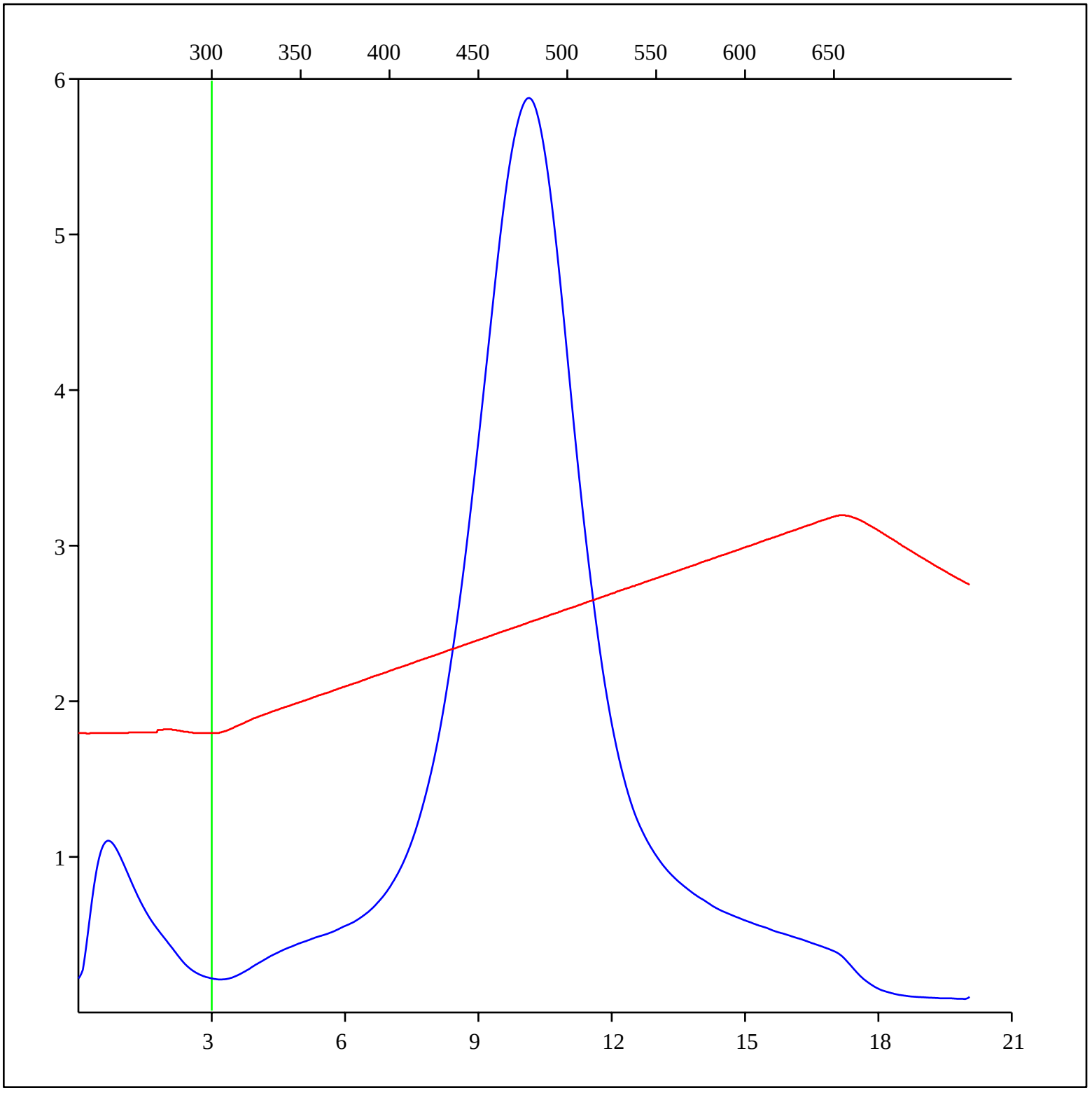
Sample: C-560393
Acquisition Date: 02-AUG-2013
Location: ULU A-35
Depth: 1721 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



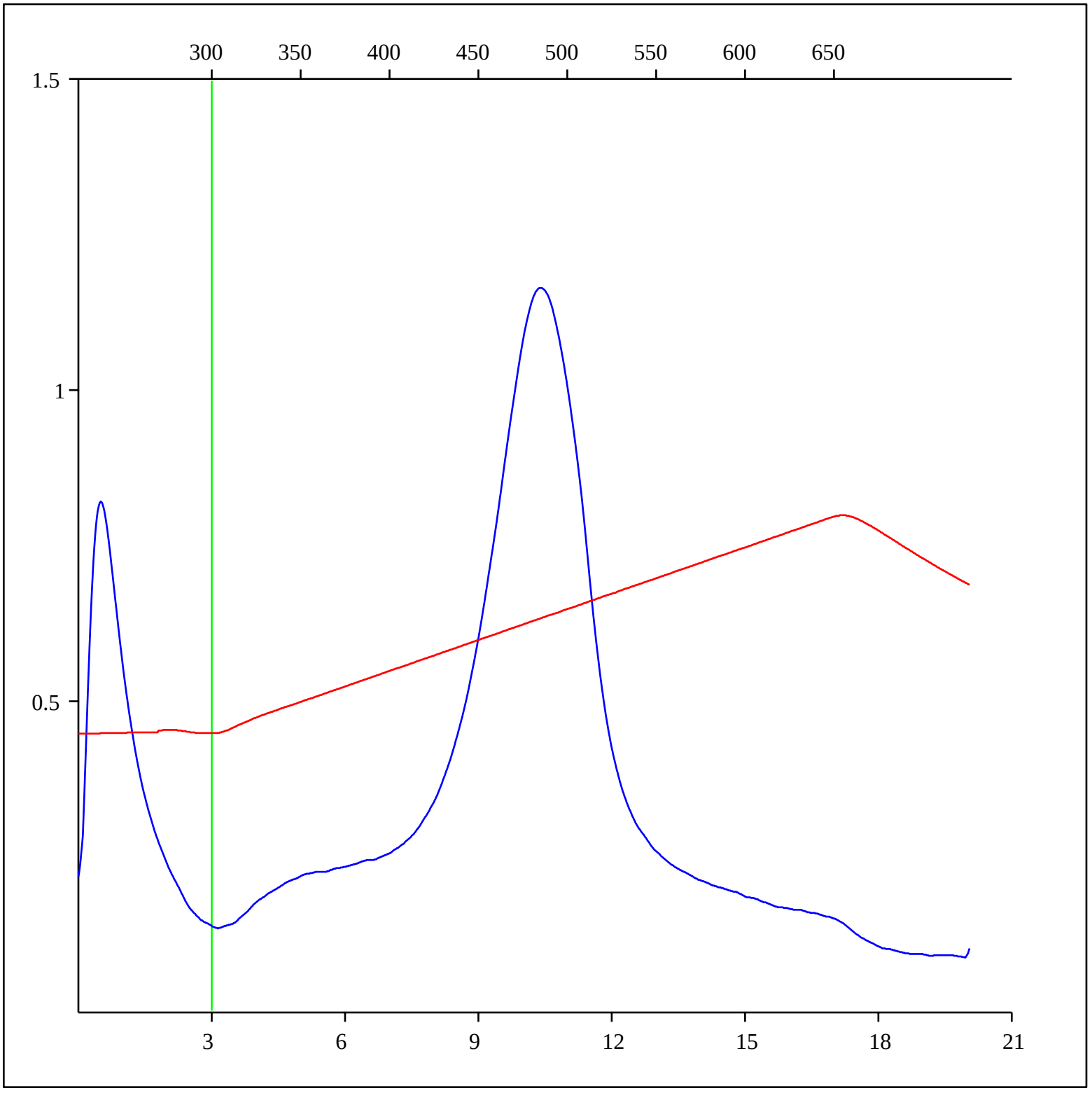
Sample: C-560394
Acquisition Date: 02-AUG-2013
Location: ULU A-35
Depth: 1874.01 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



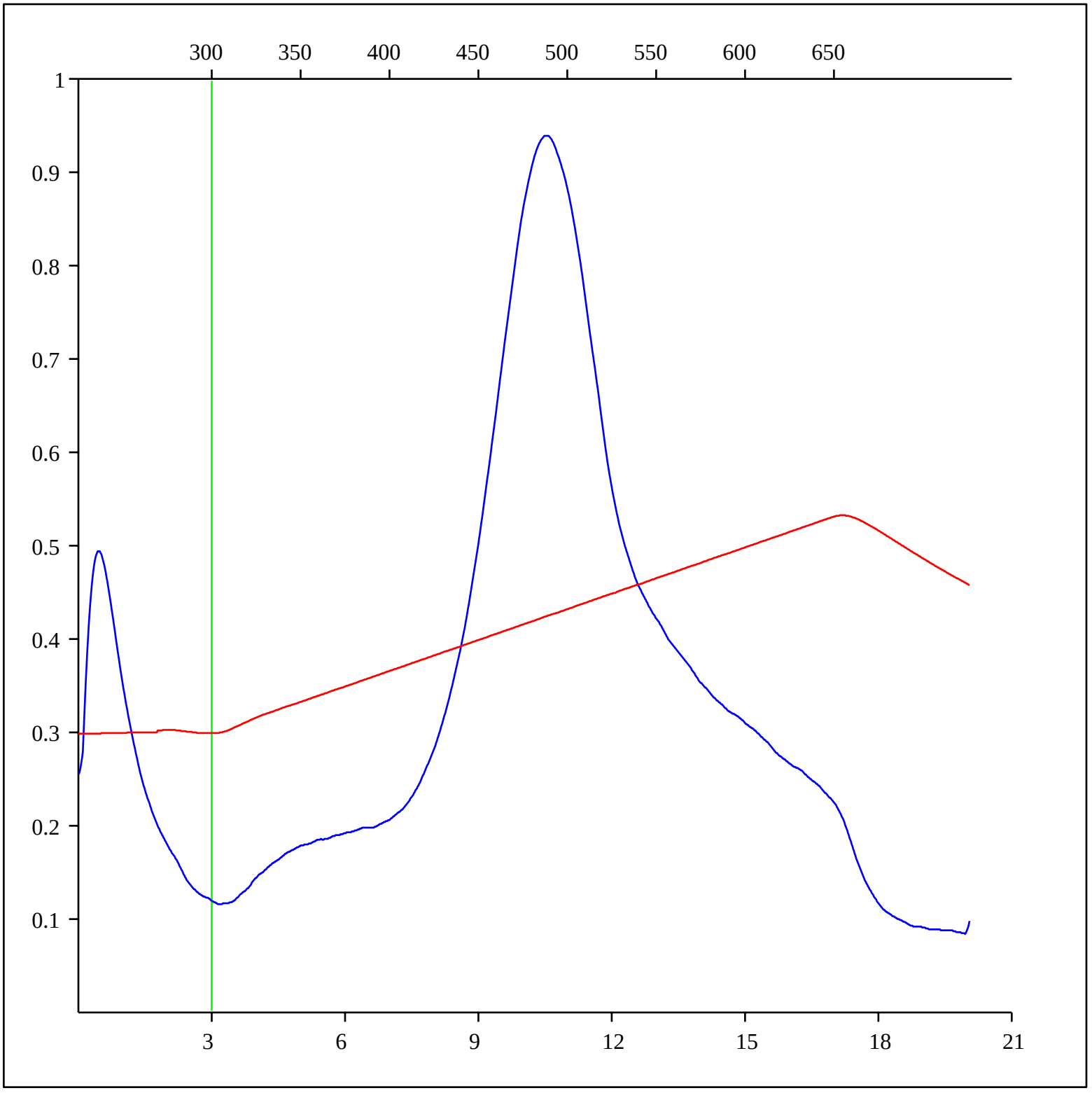
Sample: C-560395
Acquisition Date: 02-AUG-2013
Location: ULU A-35
Depth: 2941.95 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



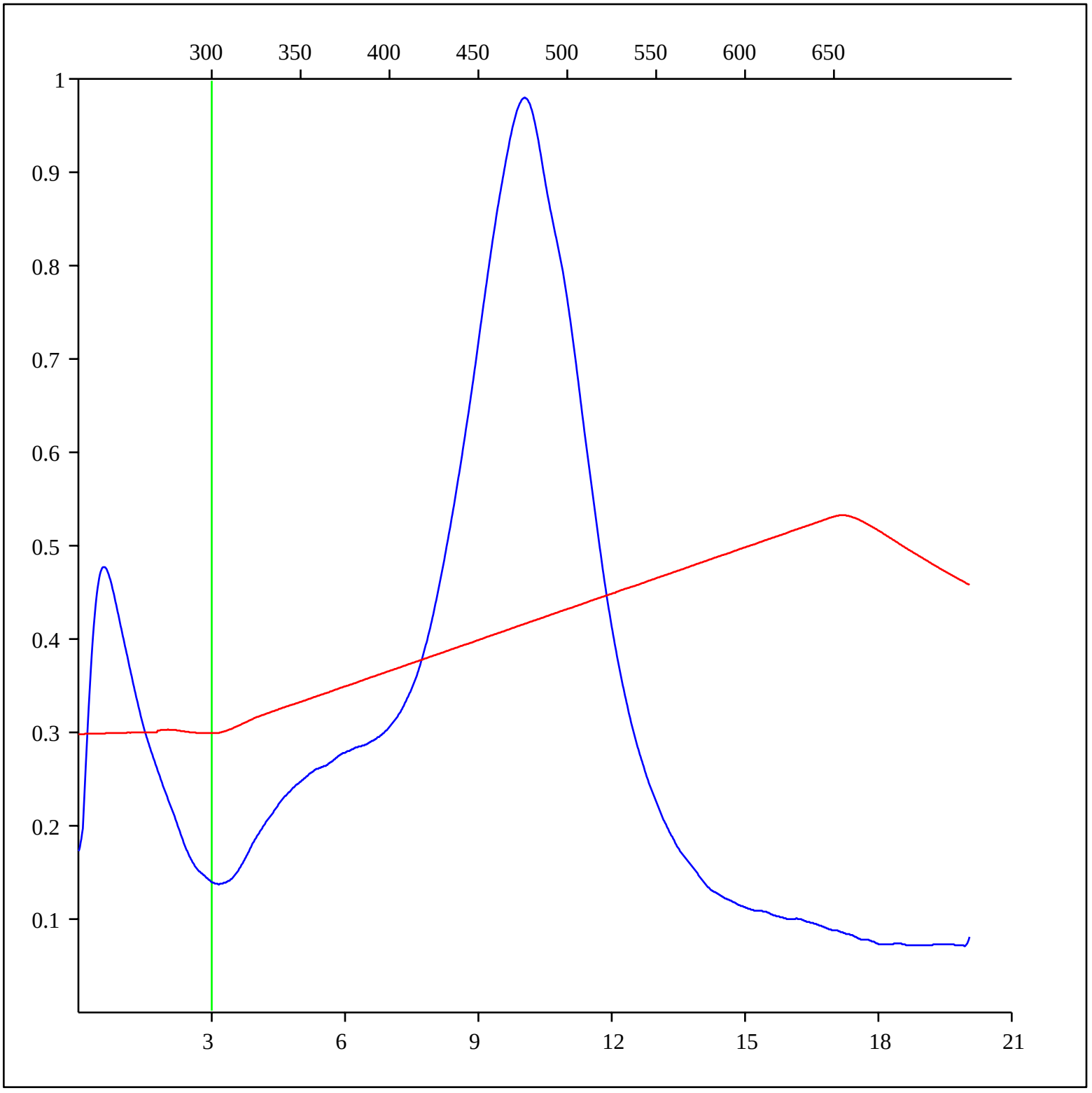
Sample: C-560396
Acquisition Date: 02-AUG-2013
Location: UNAK B-11
Depth: 2898.2 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



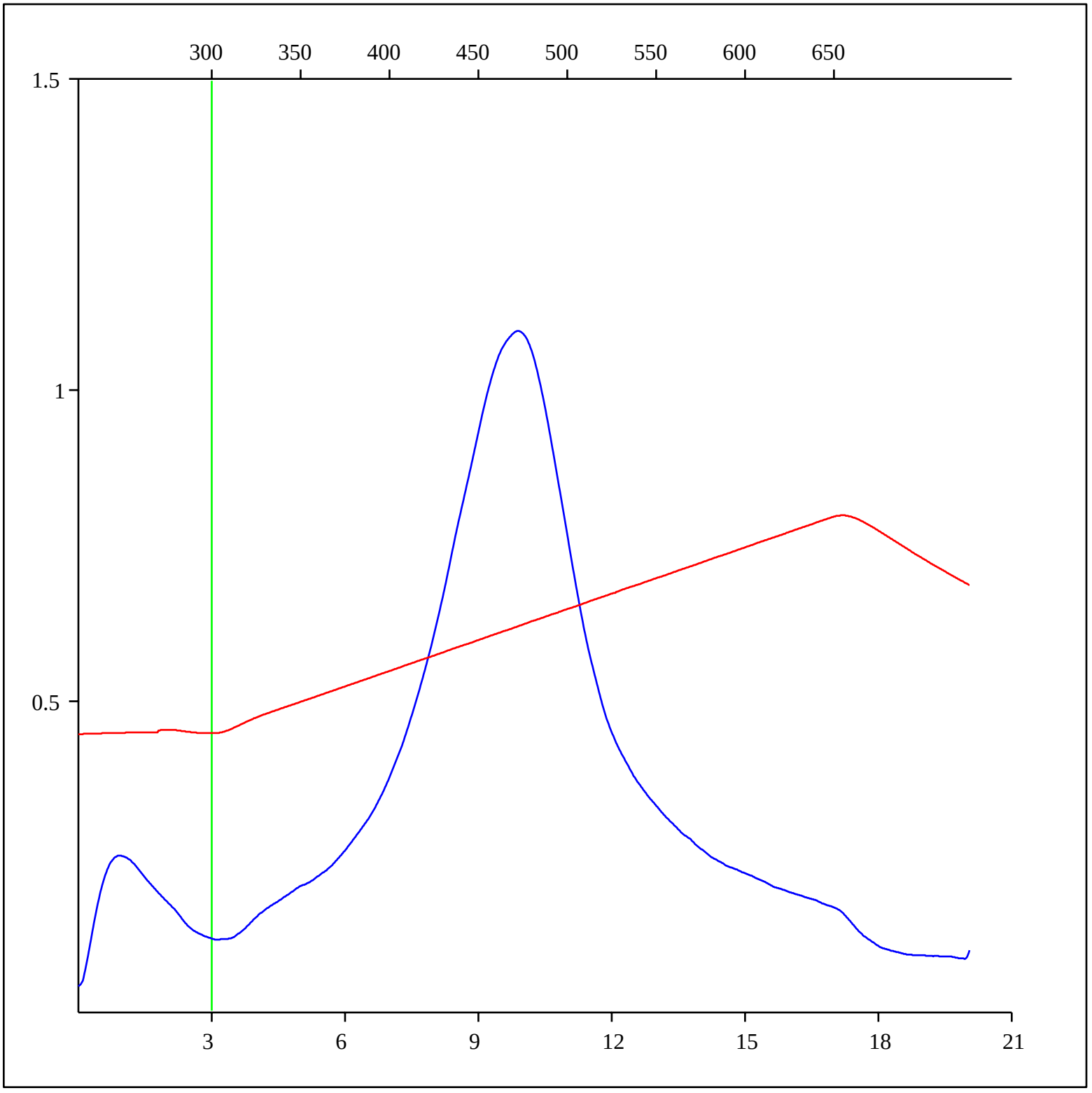
Sample: C-560397
Acquisition Date: 02-AUG-2013
Location: UNAK L-28
Depth: 3258.82 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



Sample: C-560398
Acquisition Date: 02-AUG-2013
Location: UNARK L-24
Depth: 2735.63 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons



Sample: C-560399
Acquisition Date: 02-AUG-2013
Location: UNARK L-24
Depth: 3766.3 m
Analysis
Instrument: RockEval 6
Data Processing Software: Vinci

FID hydrocarbons