Datashare 91

Petroleum system modeling of the East Coast Basin, Hawke Bay, New Zealand

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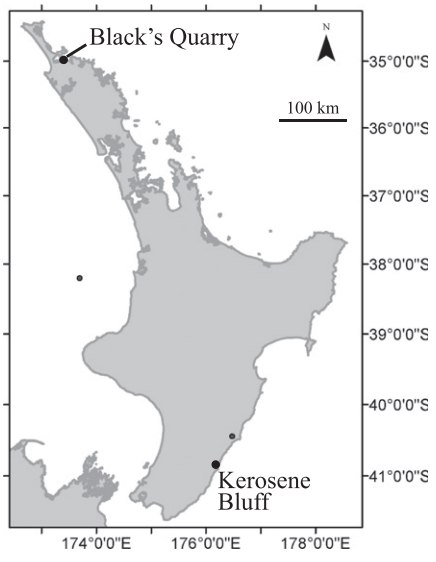
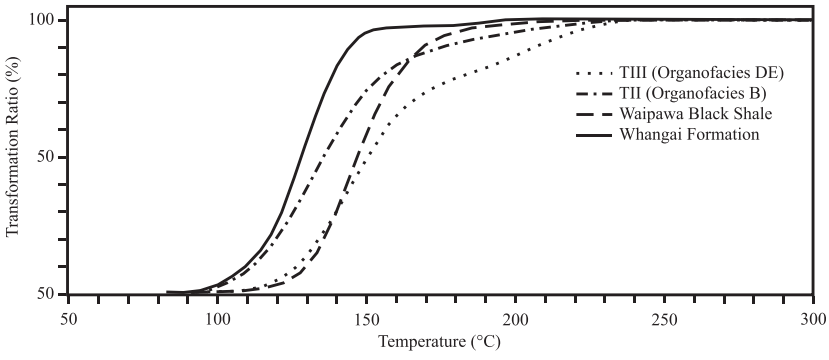
Appendix 1: Source Rock Sample Locations and Kinetics

Kinetic data used for basin and petroleum system modeling of the Waipawa Black Shale and Whangai Formation from R. Sykes and C. Boreham (2014, personal communication). Locations of samples indicated on map. Transformation ratios of kerogen to oil and gas (fraction %) for the kinetic data modeled as compared to typical type II (organofacies B) marine shales and type III (organofacies DE) deltaic shales from Pepper and Corvi (1995) from Petromod v.2013.2®.





Kinetic Data for the Whangai Formation and Waipawa Black Shale

Activation Energy (kcal/mol)	Fraction (%)
Whangai Formation*	
45	7.47
47	22.87
48	33.68
49	24.72
50	8.47
52	0.06
55	2.73
Waipawa Black Shale†	
45	0.11
46	0.29
47	0.32
48	0.44
49	0.34
50	0.17
51	0.5
52	6.5
53	22.26
54	29.5
55	14.42
56	13.14
57	5.18
58	2.63
59	2.1
62	2.1

*Sample location = Kerosene Bluff; frequency factor (1/m.y.) = 7.31×10^{25}.
†Sample location = Black's Quarry; frequency factor (1/m.y.) = 8.0156×10^{27}.

Appendix 2: Geothermal Gradients and Quality Rankings by Well

Well	Depth Below Mudline (m)	Depth Below Mudline (ft)	Temperature Source	Measured Temperature (°C)	Type of Correction	Corrected Temperature (°C)	Used to Calculate Geothermal Gradient?	Geothermal Gradient (°C/km)	Tier
Awatare 1	1075.80	3529.60	BHT	37.8	Last resort	55.8	N	21.9	1
	2131.40	6992.90	BHT	55	Horner	58	Y	21.9	1
	2083.60	6835.90	BHT	56	Horner	58	Y	21.9	1
	2083.60	6836.00	BHT	56	Horner	58	Y	21.9	1
	1950.60	6399.60	BHT	50.5	Last resort	68.5	N	21.9	1
Hawke Bay 1	1296.60	4253.90	BHT	41.1	Last resort	59.1	Y	33.5	3
	1760.60	5776.20	BHT	48.9	Last resort	66.9	Y	33.5	3
Hukarere 1	2004.00	6574.80	BHT	54.4	Last resort	72.4	N	19.9	2
	3153.00	10,344.50	BHT	72.2	Modified Horner	75.3	Y	19.9	2
	3209.00	10,528.20	BHT	72.8	Modified Horner	75.3	Y	19.9	2
Kauhauroa 1	446.9	1466.20	BHT	37.2	Last resort	55.2	Y	53.9	3
	845.9	2775.30	BHT	38.9	Last resort	56.9	Y	53.9	3
Kauhauroa 2	2128.60	6983.60	BHT	54.4	Last resort	72.4	Y	29.8	3
	1602.60	5257.90	BHT	48.9	Last resort	66.9	Y	29.8	3
Kauhauroa 3	1215.90	3989.20	BHT	37.8	Last resort	55.8	N	23.3	2
	1209.90	3969.50	BHT	40	Last resort	58	N	23.3	2
	1310.90	4300.90	BHT	40.6	Last resort	58.6	N	23.3	2
	1228.90	4031.80	DST	40.6	Not corrected		Y	23.3	2
Kauhauroa 4	345	1131.90	BHT	38.9	Last resort	56.9	Y	83.8	3
	526.1	1725.90	BHT	34.4	Last resort	52.4	Y	83.8	3
Kauhauroa 5	1273.60	4178.50	BHT	40.6	Last resort	58.6	Y	33.5	3
	1746.40	5729.70	BHT	51.1	Last resort	69.1	Y	33.5	3
	1332.60	4372.00	DST	27	Not corrected		N	33.5	3
	1340.60	4398.30	DST	25	Not corrected		N	33.5	3
Kereru 1	973.3	3193.20	BHT	32.8	Last resort	50.8	Y	39.9	3
Kiakia 1	1086.60	3565.00	BHT	33.9	Last resort	51.9	N	38	2
	1521.40	4991.50	BHT	45	Last resort	63	N	38	2
	2224.00	7296.60	BHT	52.8	Last resort	70.8	N	38	2
	1997.00	6551.80	DST	87.8	Not corrected		Y	38	2
Makareao 1	481.1	1578.40	BHT	40	Last resort	58	Y	51.9	3
	935.6	3069.60	BHT	42.2	Last resort	60.2	Y	51.9	3
	589.6	1934.40	DST	40	Not corrected		N	51.9	3
	551.4	1809.10	DST	43.3	Not corrected		N	51.9	3
Managaone 1	280	918.6	Temp Log BHT	37.8	Last resort	55.8	Y	52.4	3
	340	1115.50	BHT	31.7	Last resort	49.7	N	52.4	3
	340	1115.50	BHT	29.4	Last resort	47.4	N	52.4	3
	916	3005.20	BHT	35	Last resort	53	N	52.4	3
	916	3005.20	BHT	34.5	Last resort	52.5	N	52.4	3
	947	3107.00	Temp Log BHT	50.6	Last resort	68.6	Y	52.4	3
	1032.00	3385.80	BHT	34.4	Last resort	52.4	N	52.4	3
	1068.00	3503.90	BHT	39.4	Last resort	57.4	N	52.4	3
	1139.00	3736.90	BHT	35.6	Last resort	53.6	N	52.4	3
	1158.00	3799.20	BHT	36.7	Last resort	54.7	N	52.4	3
	1187.00	3894.40	BHT	43.3	Last resort	61.3	N	52.4	3
	1262.00	4140.40	BHT	44.4	Last resort	62.4	N	52.4	3
	1454.00	4770.30	BHT	39.4	Last resort	57.4	N	52.4	3

(*continued*)

Appendix 2: Continued

Well	Depth Below Mudline (m)	Depth Below Mudline (ft)	Temperature Source	Measured Temperature (°C)	Type of Correction	Corrected Temperature (°C)	Used to Calculate Geothermal Gradient?	Geothermal Gradient (°C/km)	Tier
	1454.00	4770.30	BHT	41.6	Last resort	59.6	N	52.4	3
	645	2116.10	DST	27.8	Not corrected		N	52.4	3
	682	2237.50	DST	31.7	Not corrected		N	52.4	3
	691	2267.10	DST	32.2	Not corrected		N	52.4	3
	721	2365.50	DST	31.1	Not corrected		N	52.4	3
	813	2667.30	DST	34.5	Not corrected		N	52.4	3
	987	3238.20	DST	39	Not corrected		N	52.4	3
	993	3257.90	DST	38.4	Not corrected		N	52.4	3
Mason Ridge 1	988	3241.50	BHT	32.2	Last resort	50.2	Y	24.9	3
	1877.00	6158.10	BHT	41.1	Last resort	59.1	Y	24.9	3
	1177.00	3861.50	BHT	42.8	Last resort	60.8	Y	24.9	3
	1878.00	6161.40	BHT	44.4	Last resort	62.4	Y	24.9	3
Ongaonga 1	477.3	1565.90	BHT	32.2	Last resort	50.2	Y	22.1	3
	1566.30	5138.80	BHT	35	Last resort	53	Y	22.1	3
Opoho 1	1645.60	5399.00	BHT	51.7	Last resort	69.7	Y	35.1	3
Opoutama 1	271.4	890.4	BHT	50	Last resort	68	N	20.2	3
	1722.40	5650.90	BHT	58.9	Last resort	76.9	N	20.2	3
	1696.40	5565.60	BHT	57.5	Last resort	75.5	N	20.2	3
	2743.40	9000.70	BHT	74.4	Last resort	92.4	N	20.2	3
	3652.00	11,981.60	BHT	70	Last resort	88	N	20.2	3
	1670.80	5481.60	Temp Log	65.5	Not corrected		Y	20.2	3
	1518.40	4981.60	Temp Log	68.6	Not corrected		Y	20.2	3
	1366.00	4481.60	Temp Log	68	Not corrected		Y	20.2	3
	1213.60	3981.60	Temp Log	66	Not corrected		Y	20.2	3
	1061.20	3481.60	Temp Log	60.5	Not corrected		Y	20.2	3
	908.8	2981.60	Temp Log	54	Not corrected		Y	20.2	3
	756.4	2481.60	Temp Log	56	Not corrected		Y	20.2	3
	604	1981.60	Temp Log	47	Not corrected		Y	20.2	3
	451.6	1481.60	Temp Log	43	Not corrected		Y	20.2	3
	299.2	981.6	Temp Log	44	Not corrected		Y	20.2	3
	146.8	481.6	Temp Log	43	Not corrected		Y	20.2	3
	−2.6	−8.4	Temp Log	35.5	Not corrected		Y	20.2	3
	3253.40	10,673.90	DST	71.1	Not corrected		N	20.2	3
Rakaiatai 1	2245.70	7367.80	BHT	128	Last resort	146	Y	59.7	3
Rere 1	2091.00	6860.20	BHT	58.9	Last resort	76.9	N	23.3	2
	4338.00	14,232.30	BHT	103.9	Last resort	121.9	N	23.3	2
	3618.00	11,870.10	BHT	82.2	Modified Horner	91.6	Y	23.3	2
	2081.90	6830.30	BHT	90.6	Modified Horner	91.6	Y	23.3	2
	4249.00	13,940.30	BHT	105.6	Modified Horner	107.6	Y	23.3	2
	4254.50	13,958.30	BHT	104.4	Modified Horner	107.6	Y	23.3	2
Rotokautuku 1	350	1148.30	BHT	41.7	Last resort	59.7	Y	94.6	3
	350	1148.30	BHT	42.8	Last resort	60.8	Y	94.6	3
	350	1148.30	BHT	42.2	Last resort	60.2	Y	94.6	3
	619	2030.80	BHT	55	Last resort	73	Y	94.6	3
	619	2030.80	BHT	56.1	Last resort	74.1	Y	94.6	3
Ruakituri 1	308	1010.50	BHT	36.7	Last resort	54.7	N	25.8	1

(*continued*)

Appendix 2: Continued

Well	Depth Below Mudline (m)	Depth Below Mudline (ft)	Temperature Source	Measured Temperature (°C)	Type of Correction	Corrected Temperature (°C)	Used to Calculate Geothermal Gradient?	Geothermal Gradient (°C/km)	Tier
	963	3159.40	BHT	44.4	Last resort	62.4	N	25.8	1
	1407.00	4616.10	BHT	46.7	Last resort	64.7	N	25.8	1
	1427.00	4681.80	BHT	47.2	Last resort	65.2	N	25.8	1
	1441.00	4727.70	BHT	43.3	Last resort	61.3	N	25.8	1
	1698.00	5570.90	BHT	52.2	Last resort	70.2	N	25.8	1
	1703.00	5587.30	BHT	57.2	Last resort	75.2	N	25.8	1
	2062.00	6765.10	BHT	55.6	Last resort	73.6	N	25.8	1
	2423.00	7949.50	BHT	61.1	Last resort	79.1	N	25.8	1
	2739.00	8986.20	BHT	71.1	Last resort	89.1	N	25.8	1
	1522.00	4993.40	DST	51.1	Not corrected		Y	25.8	1
	1408.00	4619.40	DST	49.4	Not corrected		Y	25.8	1
	887	2910.10	DST	41.7	Not corrected		Y	25.8	1
Takapau 1	301.1	987.9	BHT	29.4	Last resort	47.4	Y	30	3
	1054.10	3458.30	BHT	32.2	Last resort	50.2	Y	30	3
Taradale 1	526.2	1726.40	BHT	76.7	Last resort	94.7	Y	31.4	3
	1113.20	3652.20	BHT	71.1	Last resort	89.1	Y	31.4	3
	1646.20	5400.90	BHT	54.4	Last resort	72.4	Y	31.4	3
	1209.40	3967.80	Temp Log	65.6	Not corrected		N	31.4	3
	142.6	467.8	Temp Log	50	Not corrected		N	31.4	3
	295	967.8	Temp Log	52.8	Not corrected		N	31.4	3
	447.4	1467.80	Temp Log	55.6	Not corrected		N	31.4	3
	599.8	1967.80	Temp Log	58.3	Not corrected		N	31.4	3
	752.2	2467.80	Temp Log	59.4	Not corrected		N	31.4	3
	904.6	2967.80	Temp Log	68.3	Not corrected		N	31.4	3
	1057.00	3467.80	Temp Log	69.4	Not corrected		N	31.4	3
	1209.40	3967.80	Temp Log	65.6	Not corrected		N	31.4	3
Tawatawa 1	1270.90	4169.60	BHT	37.8	Horner	55.9	Y	33.8	1
	1308.90	4294.30	BHT	48.9	Horner	55.9	Y	33.8	1
	1228.90	4031.80	BHT	48.9	Horner	55.9	Y	33.8	1
	933.9	3064.00	BHT	32.7	Last resort	50.7	N	33.8	1
Te Hoe 1	627.2	2057.70	BHT	27	Last resort	45	Y	52.6	3
Te Horo 1	1800.10	5905.90	BHT	61.1	Last resort	79.1	Y	37.3	3
Te Puia 1	2034.80	6675.90	BHT	66.7	Modified Horner	70.9	Y	28.9	2
	2034.80	6675.90	BHT	67.8	Modified Horner	70.9	Y	28.9	2
	1474.80	4838.60	BHT	56.7	Last resort	74.7	N	28.9	2
Titihaoa 1	1851.20	6073.50	BHT	56	Modified Horner	54	Y	22.8	1
	1851.20	6073.50	BHT	55	Modified Horner	54	Y	22.8	1
	2602.20	8537.40	BHT	65	Horner	71.5	Y	22.8	1
	2602.20	8537.40	BHT	64	Horner	71.5	Y	22.8	1
	2602.20	8537.40	BHT	69	Horner	71.5	Y	22.8	1
	1454.20	4771.00	BHT	42	Last resort	60	N	22.8	1
Tuhara 1	1678.70	5507.50	BHT	43.3	Last resort	61.3	Y	27.4	3
	2194.70	7200.50	BHT	52.7	Last resort	70.7	Y	27.4	3
Tuhara 1A	2150.00	7053.80	BHT	54.4	Last resort	72.4	N	20.7	2
	1826.00	5990.80	DST	48.9	Not corrected		Y	20.7	2
	1969.00	6460.00	DST	52.8	Not corrected		Y	20.7	2

(*continued*)

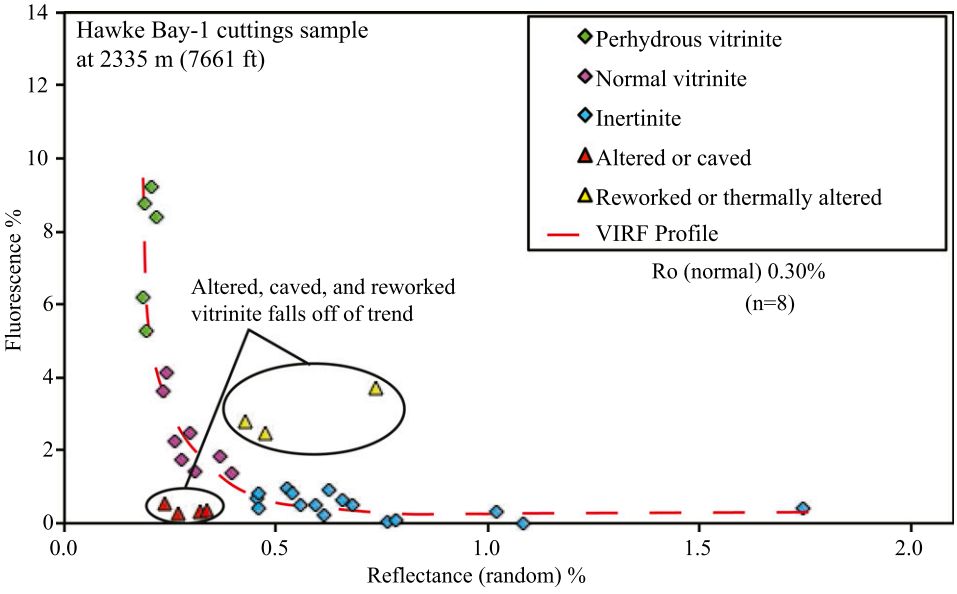
Appendix 2: Continued

Well	Depth Below Mudline (m)	Depth Below Mudline (ft)	Temperature Source	Measured Temperature (°C)	Type of Correction	Corrected Temperature (°C)	Used to Calculate Geothermal Gradient?	Geothermal Gradient (°C/km)	Tier
Waitahora 1	970.8	3185.00	BHT	48.9	Last resort	66.9	Y	42.8	3
	1203.20	3947.50	BHT	46.1	Last resort	64.1	Y	42.8	3
	1302.00	4271.70	BHT	46.1	Last resort	64.1	Y	42.8	3
Waitangi Station 1	1051.00	3448.20	BHT	39.4	Last resort	57.4	Y	30.6	3
	2131.00	6991.50	BHT	59.4	Last resort	77.4	Y	30.6	3
Waitaria 1	1145.50	3758.20	BHT	31.4	Last resort	49.4	Y	32.6	3
Waitaria 2	2133.20	6998.70	BHT	54.4	Last resort	72.4	Y	25.8	3
	2544.00	8346.50	BHT	57.8	Last resort	75.8	Y	25.8	3
	2544.00	8346.50	BHT	58.9	Last resort	76.9	Y	25.8	3
Whakatu 1	1395.10	4577.10	BHT	40	Last resort	58	Y	33	3

Geothermal gradients derived from well temperature data and quality ranking of data (tier 1 = best quality; tier 2 = poor quality; tier 3 = very poor quality). Data from open file well reports (Brown, 1960; Watson, 1962; Zimmermann et al., 1967; Darley and Kirby, 1969a, b; Leslie, 1971a, b, c; Laing, 1972a, b, c; Newkumet and Hornibrook, 1972; Heffer et al., 1976; de Bock et al., 1986; Dobbie and Carter, 1990; Biros et al., 1995; Johnston and Francis, 1996; Haskell and Johnston, 1998; Ian R. Brown Associates Ltd, 1998a, b, c, d, e, f, 1999a, b, c, d, 2000, 2001a, b, 2008; Ozolins and Francis, 2000; Tap Oil Limited, 2004).
Abbreviations: BHT = bottomhole temperature; DST = drill stem test.

Appendix 3: Vitrinite and Intertinite Reflectance and Fluorescence for Hawke Bay 1

An example of determination of vitrinite reflectance (R_o) (normal) at 2335 m (7661 ft) depth in the Hawke Bay 1 well using vitrinite–inertinite reflectance and fluorescence (VIRF) (J. Newman, 2013, personal communication). Inertinite, normal vitrinite, and suppressed vitrinite form a VIRF profile from high fluorescence and low reflectance to low fluorescence and high reflectance. In this example, normal vitrinite has fluorescence ranging from 1% to 4%. Thermally altered and reworked vitrinite falls above the VIRF profile (yellow triangles), and altered and caved vitrinite falls below the VIRF profile (red triangles). Only macerals identified as normal vitrinite are used to calculate R_o (normal).



Appendix 4: Vitrinite–Inertinite Reflectance and Fluorescence Data

Depth Below Mudline (m)	Depth Below Mudline (ft)	Reflectance (%)
Hawke Bay 1		
440	1444	0.219
440	1444	0.232
440	1444	0.244
440	1444	0.265
440	1444	0.266
440	1444	0.274
440	1444	0.275
440	1444	0.296
440	1444	0.305
440	1444	0.342
440	1444	0.35
440	1444	0.354
440	1444	0.358

(*continued*)

Appendix 4: Continued

Depth Below Mudline (m)	Depth Below Mudline (ft)	Reflectance (%)
440	1444	0.359
440	1444	0.371
440	1444	0.384
440	1444	0.415
970	3182	0.204
970	3182	0.21
970	3182	0.221
970	3182	0.226
970	3182	0.228
970	3182	0.239
970	3182	0.245
970	3182	0.252
970	3182	0.28
970	3182	0.297
970	3182	0.315
970	3182	0.318
970	3182	0.324
1420	4659	0.154
1420	4659	0.165
1420	4659	0.194
1420	4659	0.2
1420	4659	0.205
1420	4659	0.211
1420	4659	0.225
1420	4659	0.228
1420	4659	0.228
1420	4659	0.23
1420	4659	0.246
1420	4659	0.253
1420	4659	0.263
1420	4659	0.283
1420	4659	0.299
1420	4659	0.3
1950	6398	0.185
1950	6398	0.186
1950	6398	0.188
1950	6398	0.213
1950	6398	0.234
1950	6398	0.237
1950	6398	0.251
1950	6398	0.255
1950	6398	0.261
1950	6398	0.266
1950	6398	0.291
1950	6398	0.3
1950	6398	0.317

(*continued*)

Appendix 4: Continued

Depth Below Mudline (m)	Depth Below Mudline (ft)	Reflectance (%)
1950	6398	0.323
2255	7398	0.226
2255	7398	0.227
2255	7398	0.242
2255	7398	0.246
2255	7398	0.253
2255	7398	0.325
2255	7398	0.376
2255	7398	0.394
2285	7497	0.235
2285	7497	0.242
2285	7497	0.26
2285	7497	0.278
2285	7497	0.298
2285	7497	0.309
2285	7497	0.369
2285	7497	0.397
2325	7628	0.233
2325	7628	0.237
2325	7628	0.256
2325	7628	0.355
2325	7628	0.362
2325	7628	0.393
2325	7628	0.396
2325	7628	0.411
2360	7743	0.231
2360	7743	0.258
2360	7743	0.284
2360	7743	0.331
2360	7743	0.333
Hukarere 1		
1568	5144	0.237
1568	5 144	0.24
1568	5144	0.248
1568	5144	0.253
1568	5144	0.256
1568	5144	0.262
1568	5144	0.262
1568	5144	0.274
1568	5144	0.285
1568	5144	0.286
1568	5144	0.29
1568	5144	0.302
1568	5144	0.349
1568	5144	0.364
1568	5144	0.388

(*continued*)

Appendix 4: Continued

Depth Below Mudline (m)	Depth Below Mudline (ft)	Reflectance (%)
2108	6916	0.267
2108	6916	0.275
2108	6916	0.279
2108	6916	0.343
2655	8711	0.365
2655	8711	0.368
2655	8711	0.417
2829	9281	0.544
2829	9281	0.592
2829	9281	0.621
2911	9551	0.413
2911	9551	0.436
2911	9551	0.526
2911	9551	0.534
2911	9551	0.557
2911	9551	0.565
2911	9551	0.592
2911	9551	0.628
2911	9551	0.646
2911	9551	0.674
2911	9551	0.683
3021	9911	0.541
3021	9911	0.544
3021	9911	0.545
3021	9911	0.587
3021	9911	0.604
3021	9911	0.644
3021	9911	0.65
3021	9911	0.661
3021	9911	0.684
3021	9911	0.696
3085	10,121	0.551
3085	10,121	0.552
3085	10,121	0.662
3112	10,210	0.521
3112	10,210	0.528
3112	10,210	0.554
3112	10,210	0.58
3112	10,210	0.6
3112	10,210	0.604
3112	10,210	0.649
3112	10,210	0.659
3112	10,210	0.672
3112	10,210	0.688
3149	10,331	0.463
3149	10,331	0.518

(*continued*)

Appendix 4: Continued

Depth Below Mudline (m)	Depth Below Mudline (ft)	Reflectance (%)
3149	10,331	0.564
3149	10,331	0.585
3149	10,331	0.598
3149	10,331	0.642
3149	10,331	0.643
3149	10,331	0.657
3149	10,331	0.661
3221	10,568	0.466
3221	10,568	0.497
3221	10,568	0.545
3221	10,568	0.556
3221	10,568	0.56
3221	10,568	0.589
3221	10,568	0.59
3221	10,568	0.611
3221	10,568	0.658
3221	10,568	0.69
3221	10,568	0.764
Opoutama 1		
591	1939	0.324
591	1939	0.353
591	1939	0.368
591	1939	0.436
591	1939	0.47
591	1939	0.523
591	1939	0.525
591	1939	0.554
1144	3753	0.403
1144	3753	0.455
1144	3753	0.46
1144	3753	0.495
1144	3753	0.579
1144	3753	0.583
1144	3753	0.649
1144	3753	0.656
1381	4531	0.424
1381	4531	0.472
1381	4531	0.505
2704	8871	0.64
2866	9403	0.552
2866	9403	0.614
2866	9403	0.723
2866	9403	0.744
2866	9403	0.807
3030	9941	0.621
3030	9941	0.731

(*continued*)

Appendix 4: Continued

Depth Below Mudline (m)	Depth Below Mudline (ft)	Reflectance (%)
3030	9941	0.843
3030	9941	0.887
3030	9941	0.9
3030	9941	0.909
3030	9941	0.917
3179	10,430	0.771
3179	10,430	0.794
3179	10,430	0.802
3179	10,430	0.808
3179	10,430	0.823
3179	10,430	0.833
3179	10,430	0.873
3179	10,430	0.878
3179	10,430	0.951
3179	10,430	0.96
3179	10,430	0.968
3179	10,430	0.972
3179	10,430	1.019
3179	10,430	1.056
3179	10,430	1.103
3179	10,430	1.122
3360	11,024	1.204
3360	11,024	1.191
3360	11,024	1.344
3360	11,024	1.123
3360	11,024	1.15
3360	11,024	1.284
3360	11,024	0.857
3360	11,024	0.873
3360	11,024	0.915
3360	11,024	0.935
3360	11,024	1.058
3510	11,516	0.979
3510	11,516	1.017
3510	11,516	1.04
3510	11,516	1.055
3510	11,516	1.057
3510	11,516	1.057
3510	11,516	1.066
3510	11,516	1.092
3637	11,932	1.091
3637	11,932	1.122
3637	11,932	1.127
3637	11,932	1.179
3637	11,932	1.181
3637	11,932	1.189

(*continued*)

Appendix 4: Continued

Depth Below Mudline (m)	Depth Below Mudline (ft)	Reflectance (%)
3637	11,932	1.226
3637	11,932	1.249
3637	11,932	1.295
3637	11,932	1.33
3637	11,932	1.406
3637	11,932	1.457
3637	11,932	1.463
Tawatawa 1		
883	2897	0.275
883	2897	0.294
883	2897	0.297
883	2897	0.324
883	2897	0.333
883	2897	0.337
883	2897	0.34
883	2897	0.355
883	2897	0.364
983	3225	0.204
983	3225	0.236
983	3225	0.239
983	3225	0.247
983	3225	0.257
983	3225	0.273
983	3225	0.277
983	3225	0.278
983	3225	0.282
983	3225	0.289
983	3225	0.294
983	3225	0.316
983	3225	0.325
983	3225	0.33
983	3225	0.351
983	3225	0.374
1093	3586	0.238
1093	3586	0.246
1093	3586	0.334
1208	3963	0.231
1208	3963	0.28
1208	3963	0.297
1288	4226	0.237
1288	4226	0.242
1483	4865	0.211
1483	4865	0.248
1483	4865	0.268
1483	4865	0.282
1483	4865	0.284

(*continued*)

Appendix 4: Continued

Depth Below Mudline (m)	Depth Below Mudline (ft)	Reflectance (%)
1483	4865	0.288
1483	4865	0.315
1483	4865	0.316
1483	4865	0.32
1483	4865	0.325
1483	4865	0.344

Data from Newman and Moore, 2000, 2002; Newman Energy Research Ltd, 2005; and J. Newman, 2013, personal communication.

Appendix 5: Inputs for One-Dimensional Basin and Petroleum System Models

	Main Input													Boundary Conditions				
Layer	Top (m)	Top (ft)	Base (m)	Base (ft)	Thick (m)	Thick (ft)	Eroded (m)	Eroded (ft)	Depo from (Ma)	Depo to (Ma)	Eroded from (Ma)	Eroded to (Ma)	Lithology	Age (Ma)	PWD (m)	PWD (ft)	Age (Ma)	SWIT (°C)
Opoutama 1																		
Tunanui Sst	−18	−59	113	371	131	430	2000	6562	15	6	6	0	Sandstone (typical)	0	−18	−59	0	15.84
Tunanui_2	113	371	265	869	152	499			15.5	15			Sandstone (typical)	4	0	0	4	15
Formation 2	265	869	427	1401	162	531			16	15.5			Slt30_Sh70	13	25	82	13	16.93
Formation 2_2	427	1401	541	1775	114	374			19	16			Slt30_Sh70	15	500	1640	15	8
Formation 3	541	1775	704	2310	163	535			22	19			Sst90_Tuff10	16	600	1969	16	5
Formation 4	704	2310	762	2500	58	190			23	22			Limestone (shaly)	22	700	2297	22	6.36
Formation 5	762	2500	937	3074	175	574			27	23			Limestone (shaly)	56	1000	3281	56	13.99
Formation 6	937	3074	960	3150	23	75			29	28			Smectite5_Sst20_Sh75	84	2000	6562	84	14.97
Formation 7	960	3150	1192	3911	232	761			30	29			Slt60_Sst20_Sm20					
Formation 8	1192	3911	1469	4820	277	909			56	45.3			Slt95_Sm5					
Whangai Formation	1469	4820	2204	7231	735	2411			70	56			Slt30_Sh70					
Formation 10	2204	7231	2540	8333	336	1102			84	79			Slt50_Sh50					
Formation 11	2540	8333	2562	8406	22	72			86	84			Sst90_Tuff10					
Formation 12	2562	8406	3133	10,279	571	1873			93	86			Sst33_Slt33_Sh33					
Formation 13	3133	10,279	3658	12,001	525	1722			100	93			Sst33_Slt33_Sh33					
Petromod buffer	3658	12,001	3858	12,657	200	656			110	100			SHALEsand					
										110								
Hawke Bay 1																		
Hawera series	57	187	345	1132	288	945			1.6	0			SHALEsand	0	57	187	0	13.84
Nukumaruan	345	1132	510	1673	165	541			2.5	1.6			Sst33_Slt33_Sh33	2.4	613	2011	2.4	5
Mangapanian	510	1673	710	2329	200	656			3	2.5			SHALEsilt	2.45	613	2011	2.45	5
Waipipian	710	2329	1040	3412	330	1083			4.3	3			SILTsandy	3.05	666	2185	3.05	5
Opoitian	1040	3412	1190	3904	150	492			5	4.3			SILTsandy	4.3	700	2297	4.3	5
Kapitean	1190	3904	1450	4757	260	853			6.4	5			Shale (organic lean, silty)	5.11	723	2372	5.11	5
Tongaporutuan	1450	4757	2170	7119	720	2362			9	6.4			Shale (typical)	5.51	741	2431	5.51	5
Lower Tt	2180	7152	2250	7382	75	246			18.7	9			Sandstone (typical)	6.5	766	2513	6.5	5
Weber	2250	7382	2362	7749	117	384			34	30			Limestone (ooid grainstone)	8.88	938	3077	8.88	5
Petromod buffer	2362	7749	2562	8406	200	656			40	34			SHALEsand	9.27	1370	4495	9.27	5
										40				9.31	1630	5348	9.31	5
														17.1	1800	5906	17.1	5
														30	400	1312	30	12.81
														34.3	400	1312	34.3	13.27
Hukarere 1																		
Mahanga mudstone	−2	−7	387	1270	388	1273	500	1640	3.6	3	3	0	Siltstone (organic lean)	0	−2	−7	0	15.84
Mangatoro Formation	387	1270	1378	4521	991	3251			5.3	3.6			Mangatoro	1.9	175	574	1.9	12.84
Haupori sandstone	1378	4521	1560	5118	182	597			6	5.3			Sandstone (typical)	3	175	574	3	12
Waitere Formation	1560	5118	1932	6339	372	1220			11	6			Siltstone (organic lean)	4	400	1312	4	8.5
Weber Formation	1932	6339	2105	6906	173	568	0		34.5	27.3	27.3	11	Weber	4.5	175	574	4.5	12
Wanstead Formation	2105	6906	2738	8983	633	2077			50	34.5			Wanstead_20Sm	5	300	984	5	10.25
Whangai Formation	2738	8983	3060	10,039	322	1056	0		70	56	56	50	Shale (typical)	5.3	300	984	5.3	10.25

(*continued*)

Appendix 5: Continued

	Main Input													Boundary Conditions				
Layer	Top (m)	Top (ft)	Base (m)	Base (ft)	Thick (m)	Thick (ft)	Eroded (m)	Eroded (ft)	Depo from (Ma)	Depo to (Ma)	Eroded from (Ma)	Eroded to (Ma)	Lithology	Age (Ma)	PWD (m)	PWD (ft)	Age (Ma)	SWIT (°C)
Glenburn Formation	3060	10,039	3236	10,617	176	577			80	70			Sst60_Slt30_Sh10	8	250	820	8	11.12
Petromod buffer	3236	10,617	3436	11,273	200	656			84	80			SHALEsand	11	250	820	11	12.37
										84				27	1500	4921	27	7.86
														30	1000	3281	30	8.62
														32	1500	4921	32	9.07
														34	1000	3281	34	9.48
														46	1500	4921	46	12.15
Rere 1																		
Wheaoa Fm LF1	−476	−1562	368	1207	844	2769	2000	6562	21.7	15.9	15.9	0	Sst20_Slt80	0	−476	−1562	0	15.84
Wheaoa Fm LF2	368	1207	570	1870	202	663			24	21.7			Slt50_Sh50	17	700	2297	17	5
Wheaoa Fm LF3	570	1870	935	3068	365	1198			30	24			Sst33_Slt33_Sh33	20	700	2297	20	5.69
Wheaoa Fm LF3	935	3068	1153	3783	218	715			34.5	30			Sst33_Slt33_Sh33	24	700	2297	24	7
Mangatu Group	1153	3783	1508	4948	355	1165			55.8	45.3			Slt50_Sh50	34	700	2297	34	9.48
Tinui Group	1508	4948	1943	6375	435	1427			83.5	55.8			Sst10_Slt_40_Sh_50	46	200	656	46	17
Kakekare Formation_Upper	1943	6375	2448	8031	505	1657			90	86.5			Slt50_Sh50	51	200	656	51	15.3
Kakekare Fm_Upper	2448	8031	3293	10,804	845	2772			95	90			Sst15_Slt15_Sh70	54	600	1969	54	13.76
Kakekare Fm_Middle	3293	10,804	3870	12,697	577	1893			103.3	95			Sst33_Slt33_Sh33	56	700	2297	56	13.99
Petromod buffer	3870	12,697	4070	13,353	200	656			110	103.3			SHALEsand	65	700	2297	65	14.58
										110				70	75	246	70	13.89
														83	150	492	83	16.4
														88	700	2297	88	14.99
														93	700	2297	93	15
														98	100	328	98	18.03
														102	25	82	102	20.25
Tawatawa 1																		
Surface	231	758	257	843	26	85			0.5	0			Shale (typical)	0	231	758	0	12.23
Formation 1	257	843	728	2388	471	1545			5	0.5			Shale (typical)	5.5	400	1312	5.5	8.5
Formation 2	728	2388	978	3209	250	820			7.5	5			Formation 2	6.5	800	2625	6.5	5
Formation 3	978	3209	1109	3638	131	430			9	7.5			Formation 3	8	700	2297	8	5
Formation 4	1109	3638	1152	3780	43	141			10.6	9			Formation 3	9.3	800	2625	9.3	5
Formation 5	1152	3780	1341	4400	189	620			10.8	10.6			Formation 3	10.57	1000	3281	10.57	5
Formation 6	1341	4400	1538	5046	197	646			10.95	10.8			Formation 3	10.8	900	2953	10.8	5
Petromod buffer	1538	5046	1738	5702	200	656			13	10.95			SHALEsand	11	1000	3281	11	5
										13								
Titihaoa 1																		
Clay	126	413	612	2008	486	1594			3.6	0			Shale (organic lean, typical)	0	126	413	0	12.84
Whangaehu Formation	612	2008	735	2411	123	404			4	3.6			Sst2_Sh98	1.63	300	984	1.63	10.88
Whangaehu Formation	735	2411	1669	5476	934	3064	200	656	11	5	5	4	Sst2_Sh98	2.5	500	1640	2.5	6.86
Calcareous MS Fm	1669	5476	1922	6306	253	830			12	11			Sh80_Mic20	3.3	500	1640	3.3	6.75
Whakataki Fm	1922	6306	2727	8947	805	2641			15	12			Sst33_Slt33_Sh33_1	4.5	600	1969	4.5	5
Petromod buffer	2727	8947	4000	13,123	1273	4177			17	15			SHALEsand	5.5	600	1969	5.5	5
										17				7	900	2953	7	5
														11	900	2953	11	5
														12	1250	4101	12	5
														15	1250	4101	15	5

Abbreviations: Depo = deposited; Fm = Formation; MS = mudstone; PWD = paleowater depth; SWIT = sediment–water interface temperature; Sst = Sandstone; Tt = Tongaporutuan.

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