Supplementary Table S1: Calibration Indicator Percent for the Three Bathymetric Models.

Calibrated Models	COST G-2		Bonnet P-23		Mohawk B-93		Monterey Jack E-43A		Total Well Thickness	Total Facies	Total Well (thickness + facies)	Thickness Map
	Thickness	Facies	Thickness	Facies	Thickness	Facies	Thickness	Facies				
Shallow Ramp (Ref)	99.34	67.26	99.02	82.18	95.22	74.88	99.4	87.47	98.87	76.23	87.55	97.67
Model B	99.4	67.41	99.85	88.24	96.37	77.03	98.38	87.46	99.21	78.89	89.05	95.81
Model C	99.39	68.08	99.28	88.24	96.3	72.86	89.63	87.4	97.95	78.81	88.38	97.56

For example, a 100 % match would occur if the model simulated 10 m of sandstone at a reference well, and the actual reference well reported 10 m of sandstone; whereas an 85 % match would occur if the model simulated 7 m of sandstone and 3 m of shale. This is due to the limitation associated with the cell size of the model, therefore, simulating shale when the well reports sandstone yields a 50 % calibration instead of 0 %.

Supplementary Table S2: Lithofacies Classification Scheme used in the Models.

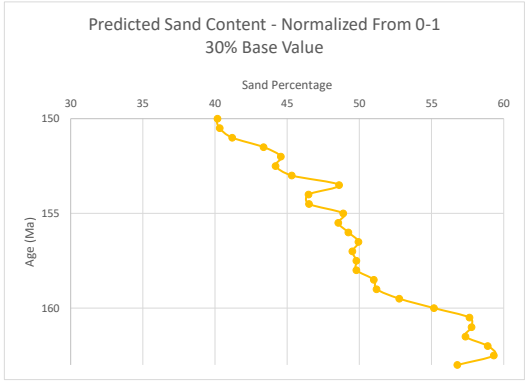
Facies	Slope Min	Slope Max	Carbonate Mud Min	Carbonate Mud Max	Bathymetry Min	Bathymetry Max	Water Discharge Min	Water Discharge Max	Sand Min	Sand Max	Reef Min	Reef Max	Shale Min	Shale Max
Continental Sand					-1000	0			40	100				
Detrital Carbonate					100	4500					15	100		
Lagoon					0	10			0	30	1	50		
Marine Sandstones					0	250			30	100				
Marls			35	100	0	4500							0	48
Muds			0	51.9	0	4500							35	100
Reef					-100	200					30	100		
Sand Lobe and BFF	0	50			140	4500			20	100				
Shale					-1000	4500							30	100
Shaly Slope and BFF	20	1000			100	4500	0	200					50	100
Slope Sands	10	1000			50	4500			27	100				

Supplementary Table S3: Sediment Supply values for the reference case model.

Source		Phase 1 (163-161 Ma)					Phase 2 (161-153.1 Ma)											Phase 3 (153.1-150 Ma)				
Age (Ma)		**163**	**162**	**161.5**	**161.4**	**161.3**	**161**	**160**	**159**	**158**	**157.8**	**157**	**156.5**	**156**	**155**	**154**	**153.3**	**153.1**	**153**	**152**	**151**	**150**
Maine	Supply (km^3/Ma)	900	700	1100	1100	1400	2400	3100	2300	2600	2300	2600	2300	2300	2500	2300	2350	1800	1000	350	350	150
	Fluvial Discharge (m^3/s)	1300	1300	2000	1600	1900	3300	4400	4400	4800	4800	5300	4400	4400	3500	3000	3100	2500	1500	400	400	400
	Sand (%)	56.8	58.89	58	58.54	58.48	57.78	55.17	51.2	49.8	49.7	49.52	49.38	49.24	40	40	45.67	45.44	45.32	44.57	41.19	40.17
	Shale (%)	43.2	41.11	42	41.46	41.52	42.22	44.83	48.8	50.2	50.3	50.48	50.62	50.76	60	60	54.33	54.56	54.68	55.43	58.81	59.83
Bay of Fundy	Supply (km^3/Ma)	500	1500	1000	950	800	1500	3500	2500	2500	2000	2000	1600	1700	800	500	1250	1400	1500	1500	1800	2000
	Fluvial Discharge (m^3/s)	1500	2500	2000	1900	2000	3000	4000	3000	3500	2950	2500	2300	2500	2100	1500	2000	2400	2500	2500	2000	2800
	Sand (%)	56.8	58.89	58	58.54	58.48	57.78	55.17	51.2	49.8	49.7	49.52	49.38	49.24	48.89	46.48	45.67	45.44	45.32	44.57	41.19	40.17
	Shale (%)	43.2	41.11	42	41.46	41.52	42.22	44.83	48.8	50.2	50.3	50.48	50.62	50.76	51.11	53.52	54.33	54.56	54.68	55.43	58.81	59.83
Meguma	Supply (km^3/Ma)	50	200	250	200	200	250	250	200	200	50	100	150	150	200	300	300	260	250	200	300	350
	Fluvial Discharge (m^3/s)	200	400	400	250	500	300	500	400	500	300	550	300	200	400	400	475	490	500	600	500	550
	Sand (%)	30	20	30	35	40	57.78	55.17	51.2	49.8	40	40	40	45	48.89	46.48	45.67	45.44	45.32	44.57	41.19	40.17
	Shale (%)	70	80	70	65	60	42.22	44.83	48.8	50.2	60	60	60	55	51.11	53.52	54.33	54.56	54.68	55.43	58.81	59.83

Haq (2014) Sea Level

Age	m		1-norm	30%
150	154.4	1	1	30
150.5	153.3	0.991959064	1.008041	30.24123
151	147.1	0.946637427	1.053363	31.60088
151.5	131.6	0.833333333	1.166667	35
152	123	0.770467836	1.229532	36.88596
152.5	125.6	0.789473684	1.210526	36.31579
153	117.6	0.730994152	1.269006	38.07018
153.5	94.2	0.55994152	1.440058	43.20175
154	109.3	0.670321637	1.329678	39.89035
154.5	109.1	0.668859649	1.33114	39.93421
155	92.1	0.544590643	1.455409	43.66228
155.5	94.6	0.562865497	1.437135	43.11404
156	89.6	0.526315789	1.473684	44.21053
156.5	84.6	0.489766082	1.510234	45.30702
157	87.6	0.511695906	1.488304	44.64912
157.5	85.6	0.497076023	1.502924	45.08772
158	85.6	0.497076023	1.502924	45.08772
158.5	77	0.434210526	1.565789	46.97368
159	75.6	0.423976608	1.576023	47.2807
159.5	64.4	0.342105263	1.657895	49.73684
160	47.2	0.216374269	1.783626	53.50877
160.5	29.6	0.087719298	1.912281	57.36842
161	28.6	0.080409357	1.919591	57.58772
161.5	31.6	0.102339181	1.897661	56.92982
162	20.6	0.021929825	1.97807	59.34211
162.5	17.6	0	2	60
163	35.6	0.131578947	1.868421	56.05263



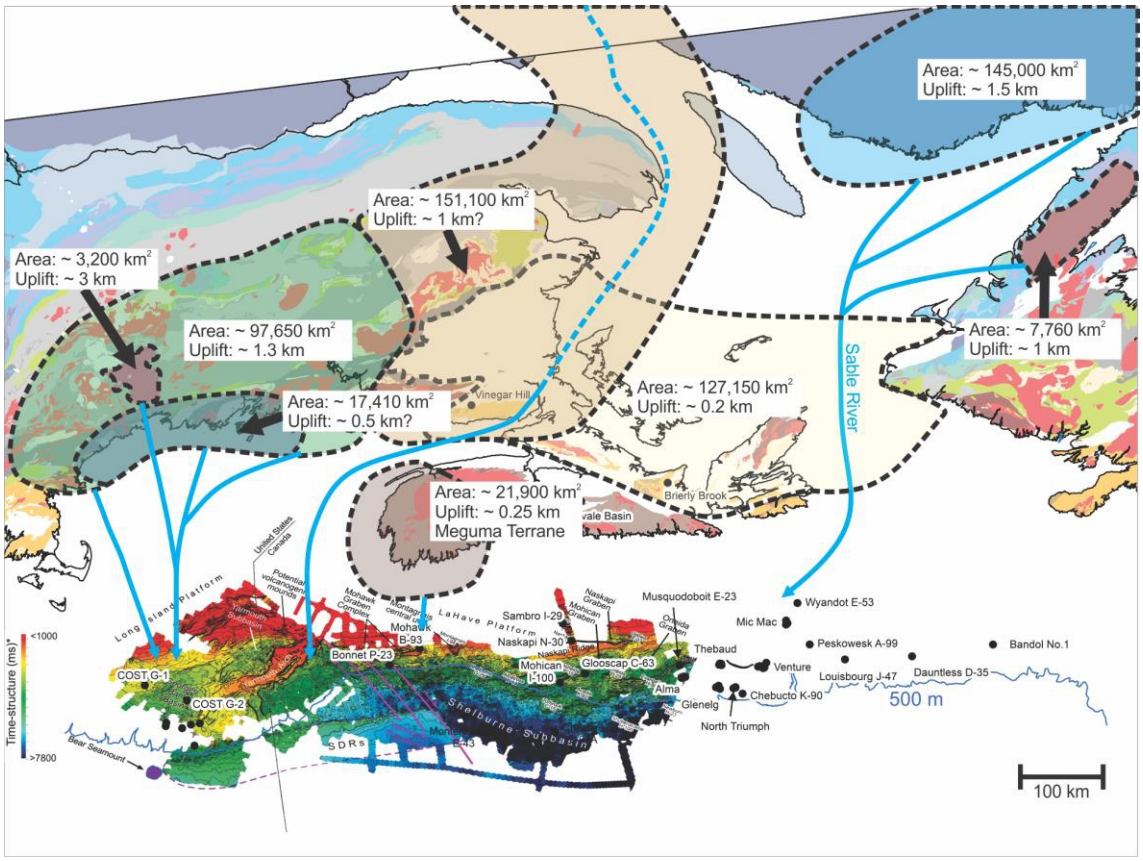
*Assume the river system brough in at least 30% sand.

Equation

Sand Proportion = 0.3 ([1-(sea level-minimum sea level for interval/(maximum sea level interval-minimum sea level for interval))] + 1) *100

Supplementary Table S4: Carbonate Production and Hemipelagic sedimentation rates for the reference case model.

Age (Ma)	**163**	**162.5**	**162**	**161.7**	**161.5**	**161.3**	**160.9**	**160**	**150**	**0**
Carbonate Mud (m/Ma)	0	10	10	30	35	40	45	35	40	18
Reef (m/Ma)	0	250	250	250	250	250	250	250	250	180
Hemipelagic Shale (m/Ma)	10	10	10	10	10	10	10	35	45	10

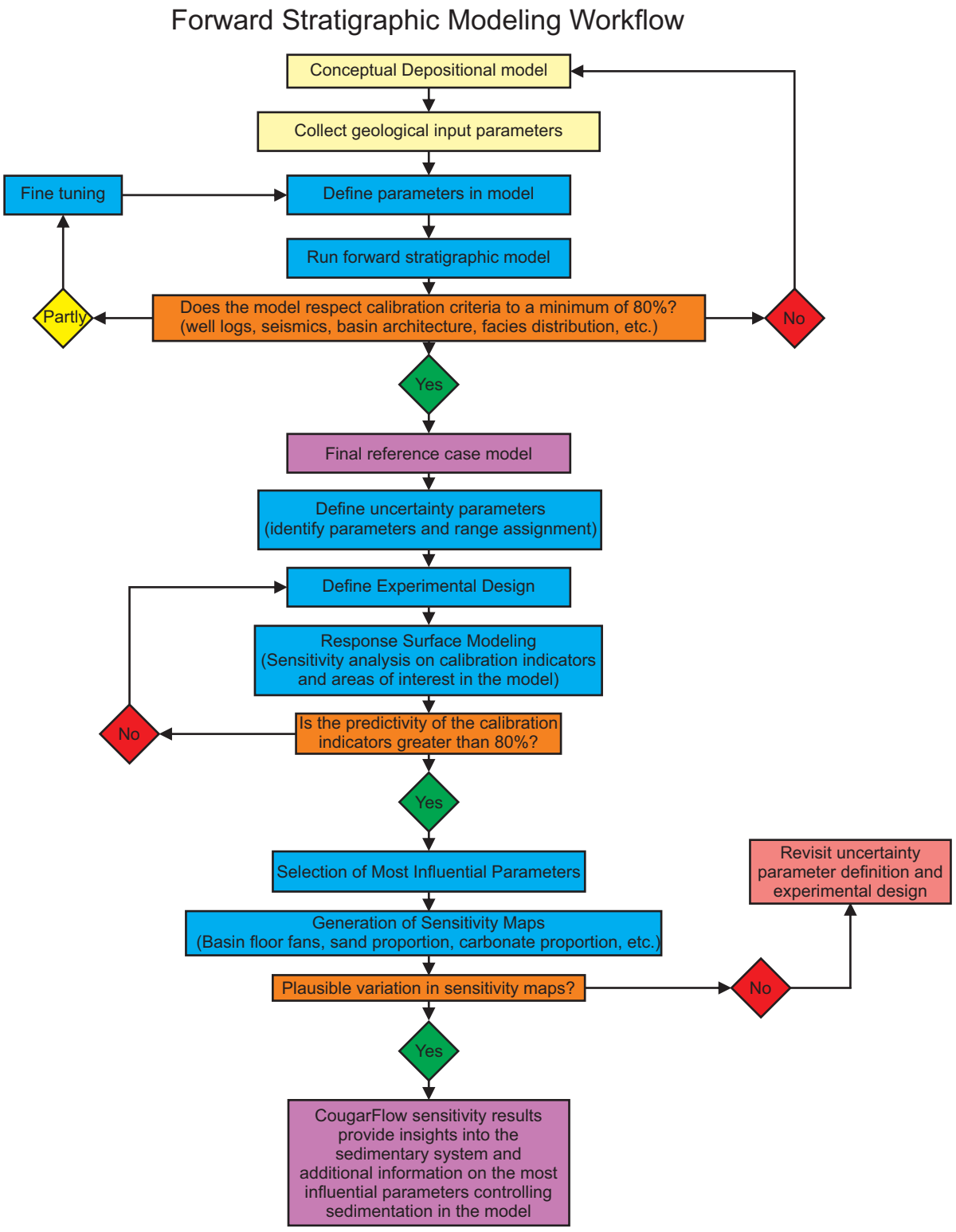


Source River	Source Area	Area (km²)	Uplift (km)	Water Discharge (m³/s)			Sediment Load (km³/Ma)
				Max	Min	Avg.	
Bay of Fundy Area	Appalachians + Maritimes Basin	151100	1?	3900	225	2062.5	1070
Maine	Appalachians	97650	1.3	2872	183	1527.5	1353
	Coastal Maine	17410	0.5?	1127	65	596	284
	White Mountians	3200	3	361	11	186	2348
Meguma Terrane	Shear Zones	50	0.4	6	1	3.5	
	Inner Shelf and Onshore Nova Scotia	55150	0.25	2000	145	1072.5	417

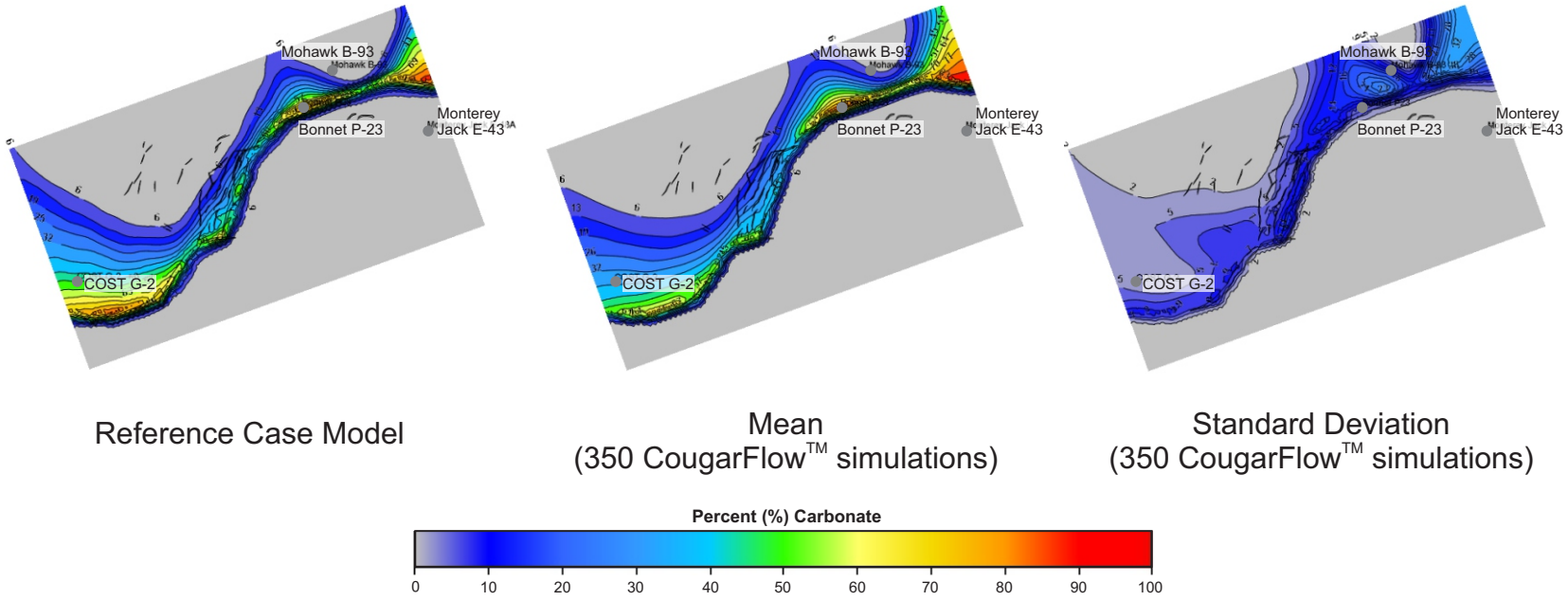
Supplementary Appendix 5: River catchment areas and table of respective uplift values (Fig. 6) and estimated sediment load and water discharge values from Table 1.

Supplementary Table S6: Uncertain Parameters used for CougarFlow Analysis.

Uncertain Parameters	Minimum Value	Maximum Value
Initial Bathymetry	32%	-
Bay of Fundy Water Discharge	-20%	50%
Maine Water Discharge	-20%	50%
Meguma Water Discharge	-20%	50%
Bay of Fundy Source Location	-30km	+30km
Maine Source Location	-30km	+30km
Meguma Source Location	-30km	+30km
Bay of Fundy Sediment Proportion	-20%	20%
Maine Sediment Proportion	-20%	20%
Meguma Sediment Proportion	-20%	20%
Production vs Time	-20%	20%
Sand Kcontinental	20	2000
Sand Kmarine	0.05	5
HEST/LELT ratio	1.6	10
Eustasy Curve	-20%	20%



Supplementary Appendix 7: DionisosFlow and CougarFlow modeling workflow.

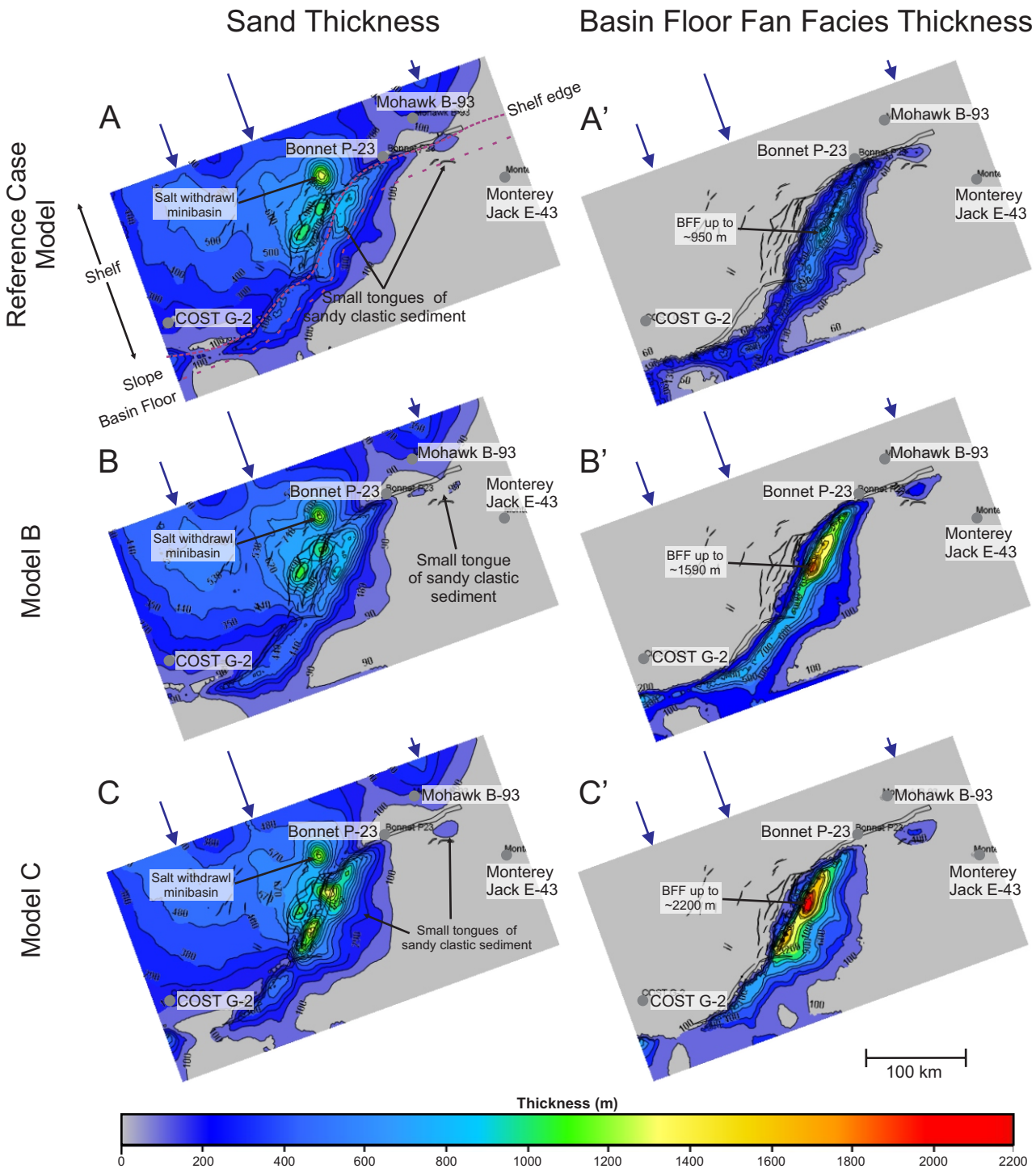


Reference Case Model

Mean
(350 CougarFlow™ simulations)

Standard Deviation
(350 CougarFlow™ simulations)

Supplementary Appendix 8: CougarFlow analysis of carbonate distribution.



Supplementary Appendix 9: Comparison of sand thickness (A, B, C) and Basin Floor Fan Facies thickness (A', B', C') from the Reference Case Model, Model B, and Model C.

Supplementary Appendix S10: Well calibration for the three models

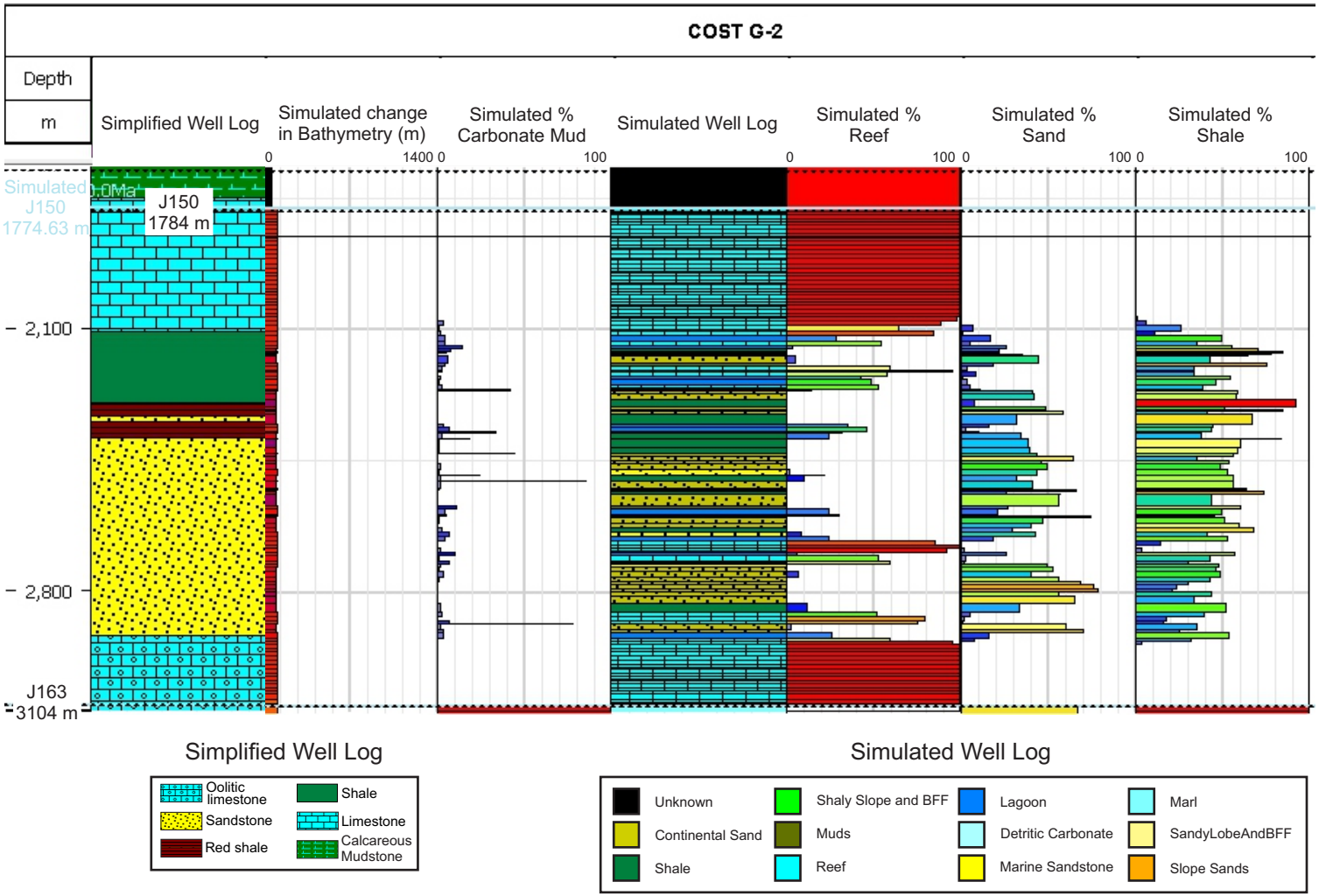


Figure S10.1: Shallow ramp reference case well calibration.

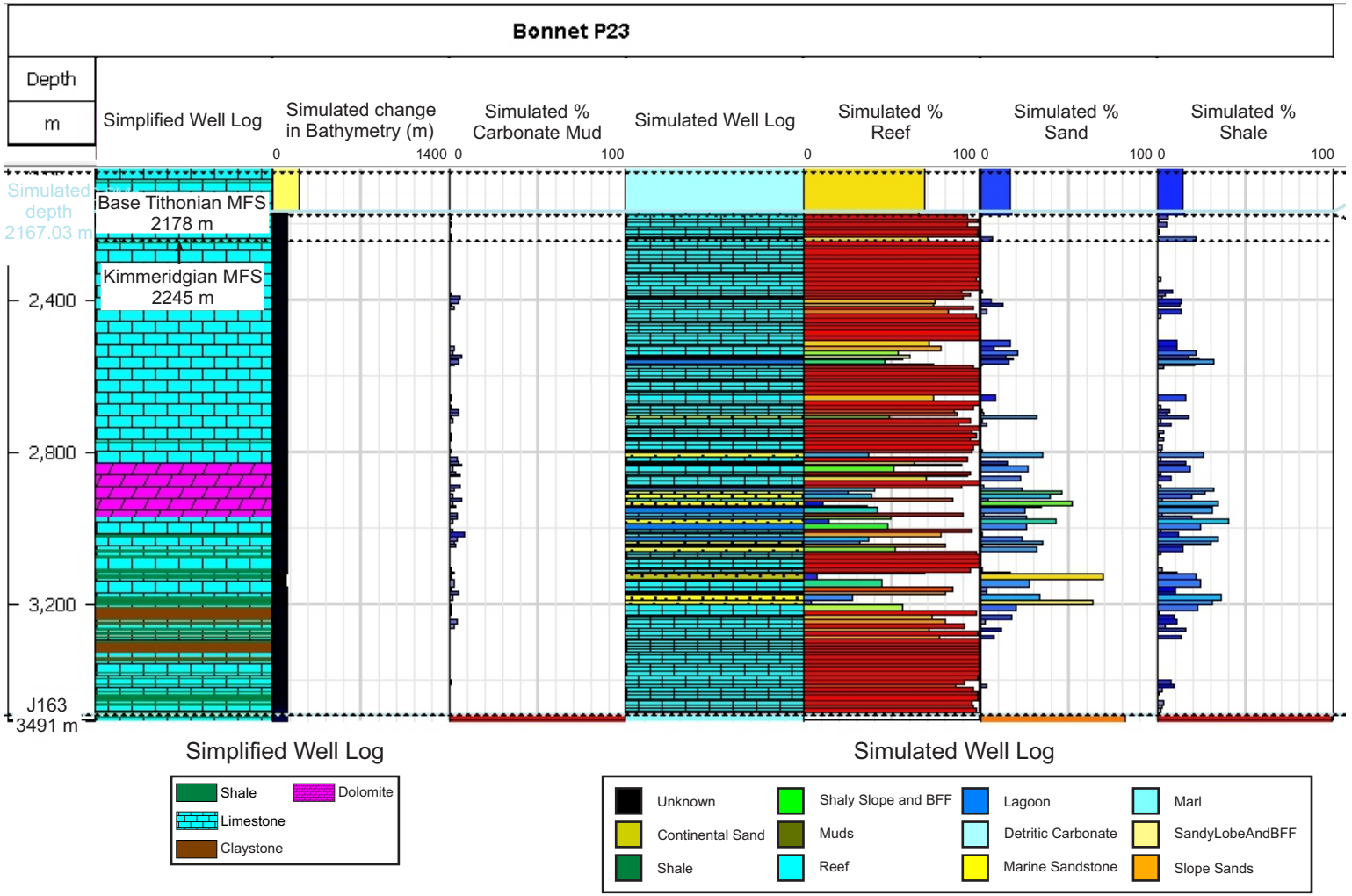


Figure S10.2: Shallow ramp reference case well calibration.

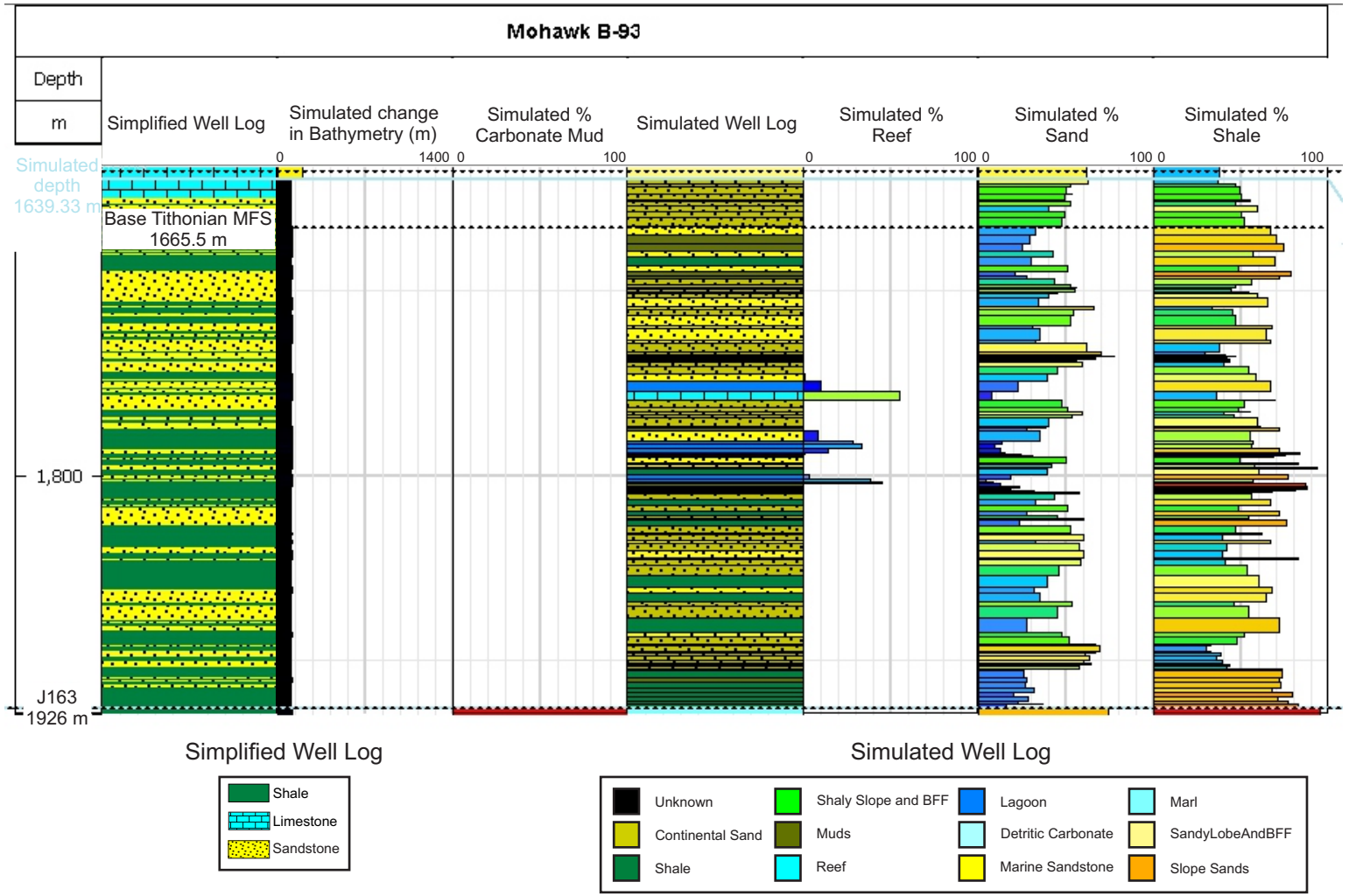


Figure S10.3: Shallow ramp reference case well calibration.

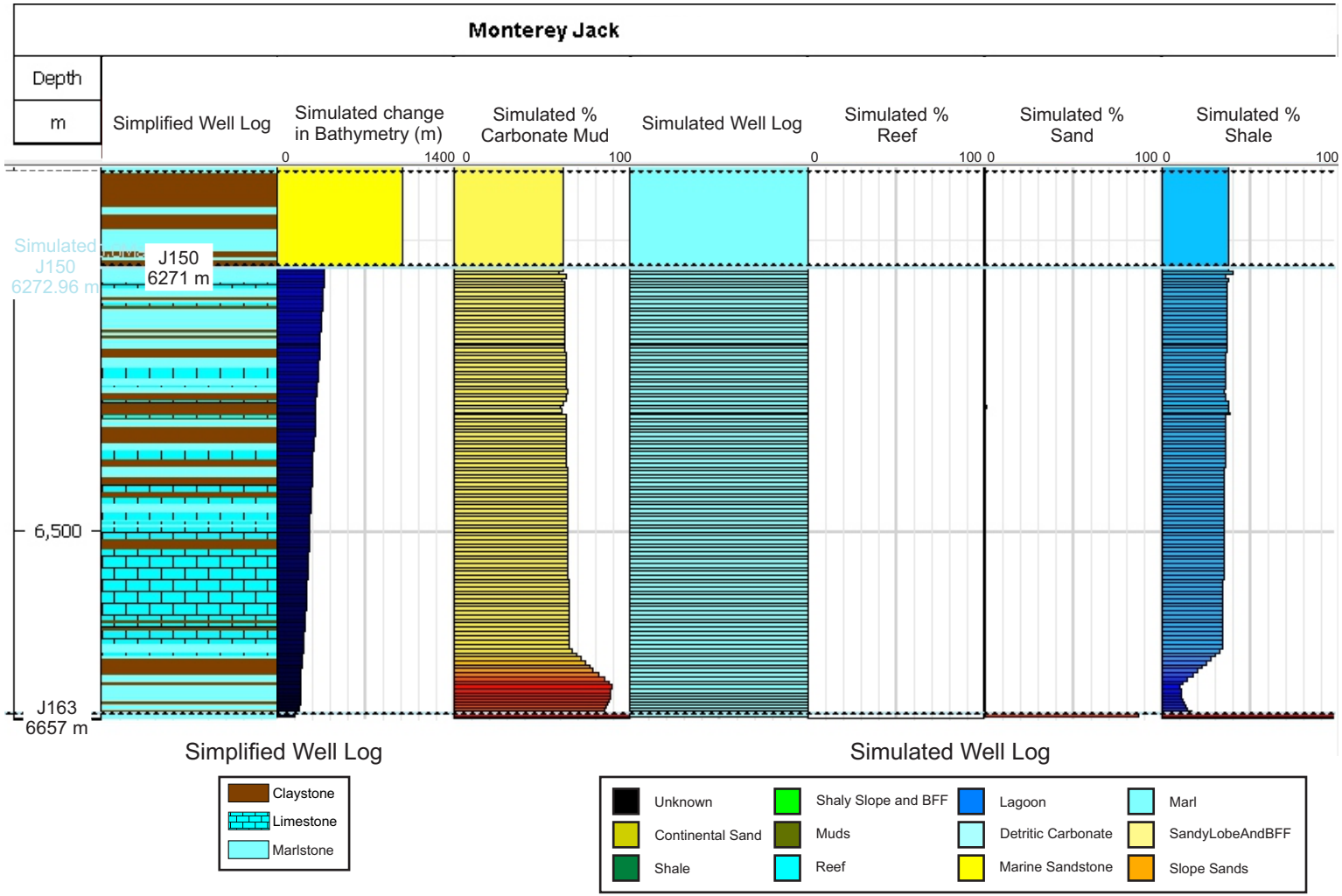


Figure S10.4: Shallow ramp reference case well calibration.

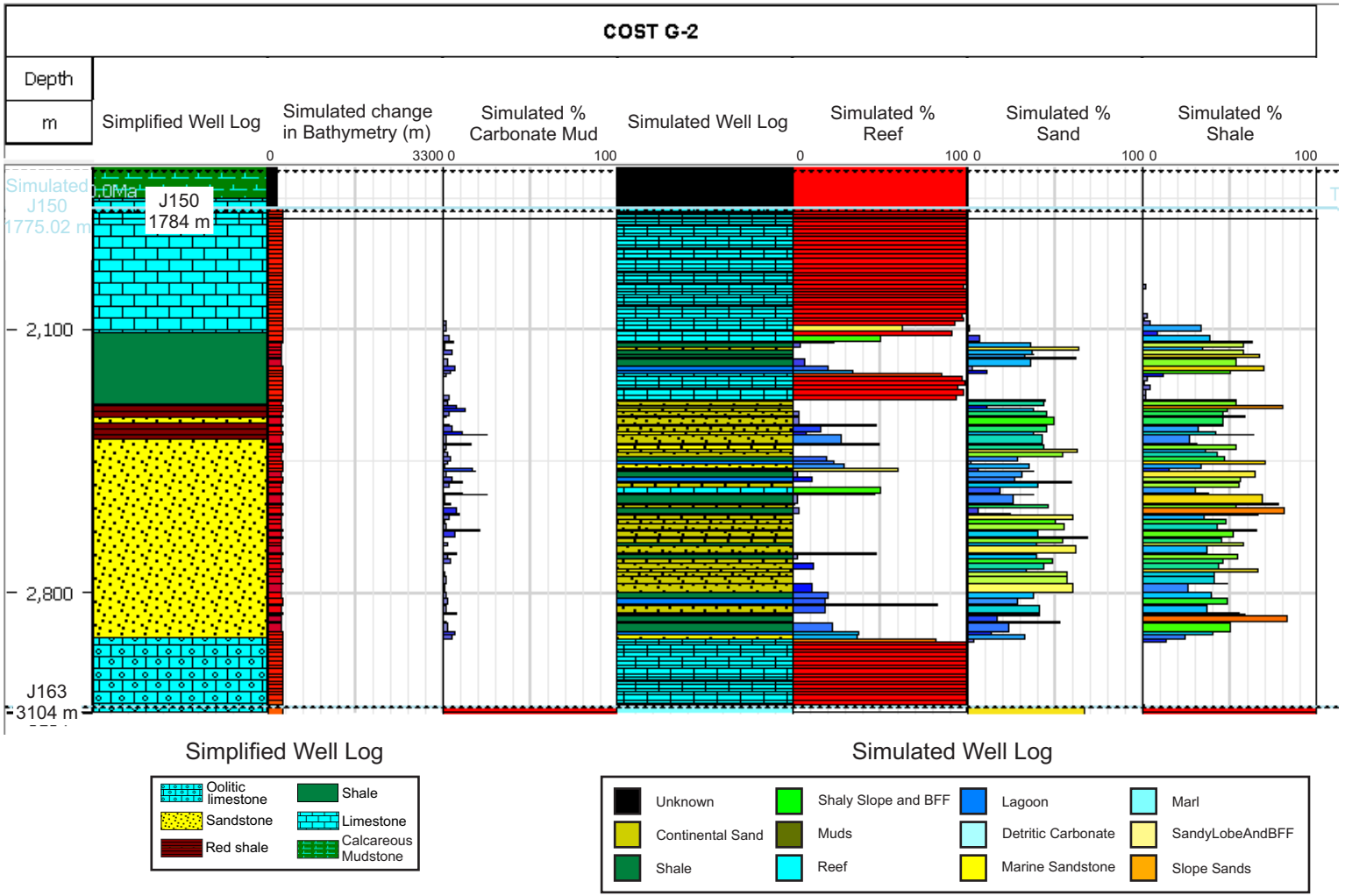


Figure S10.5: Model B (persistent reef) reference case well calibration.

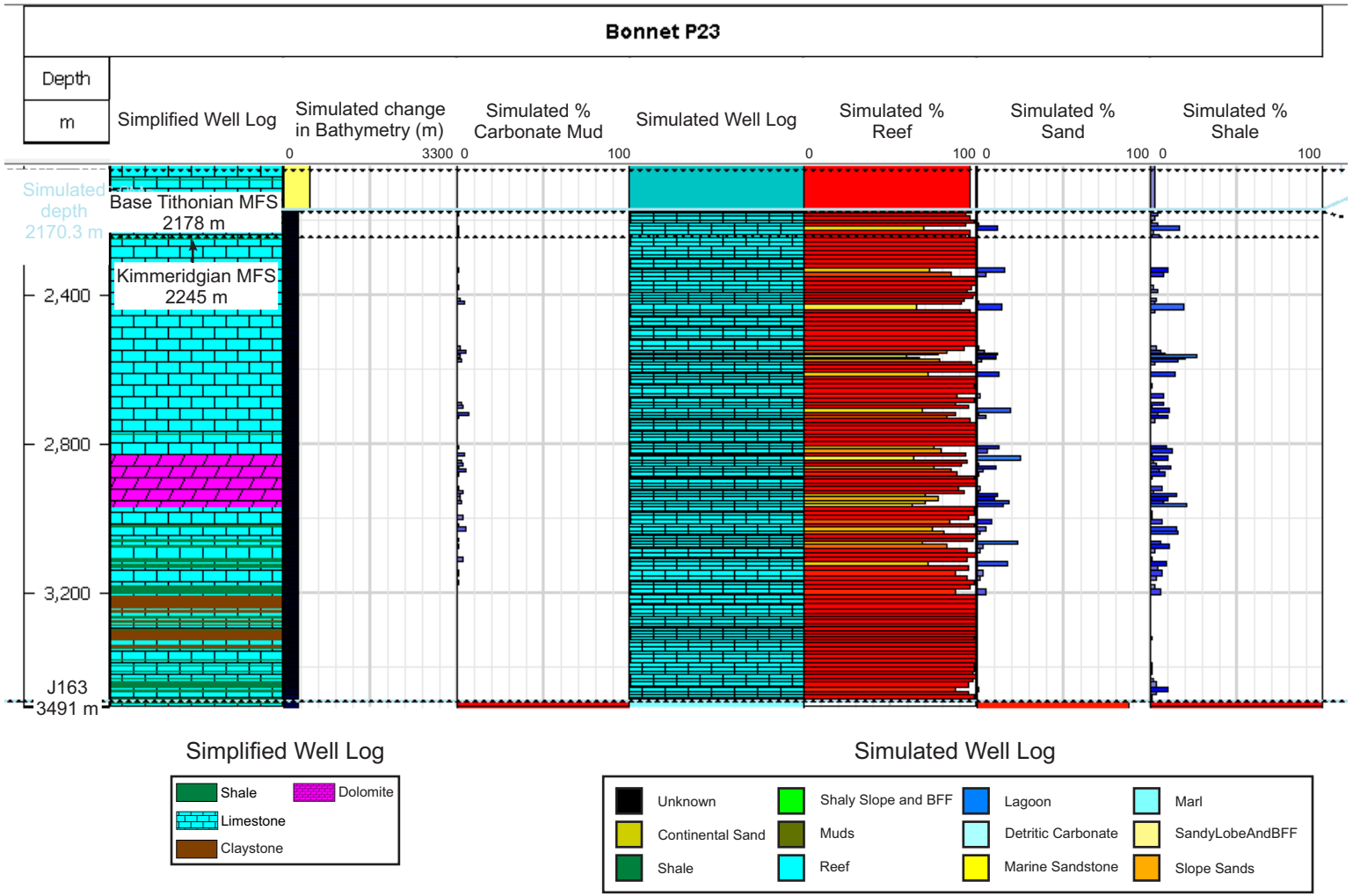


Figure S10.6: Model B (persistent reef) reference case well calibration.

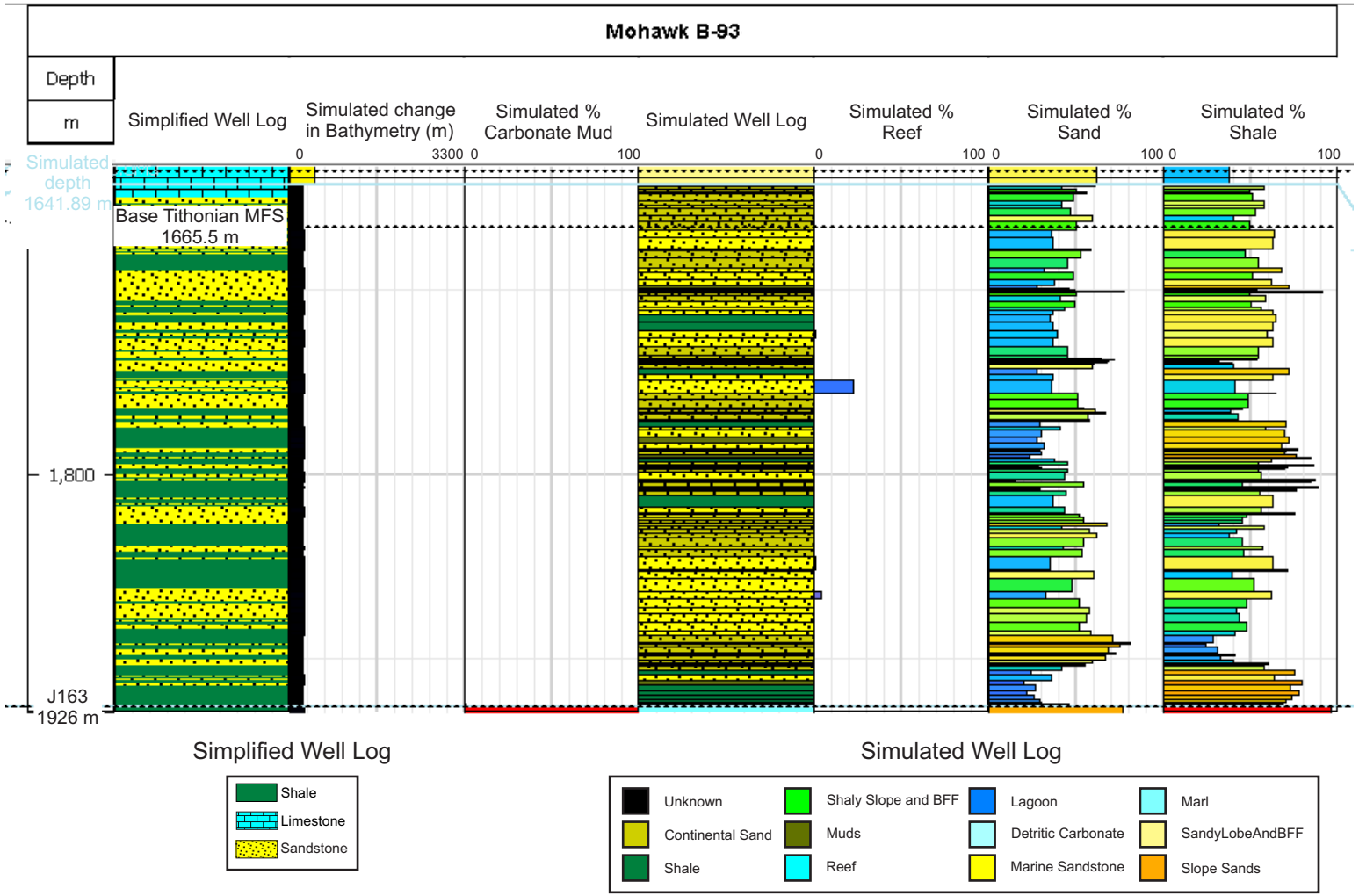


Figure S10.7: Model B (persistent reef) reference case well calibration.

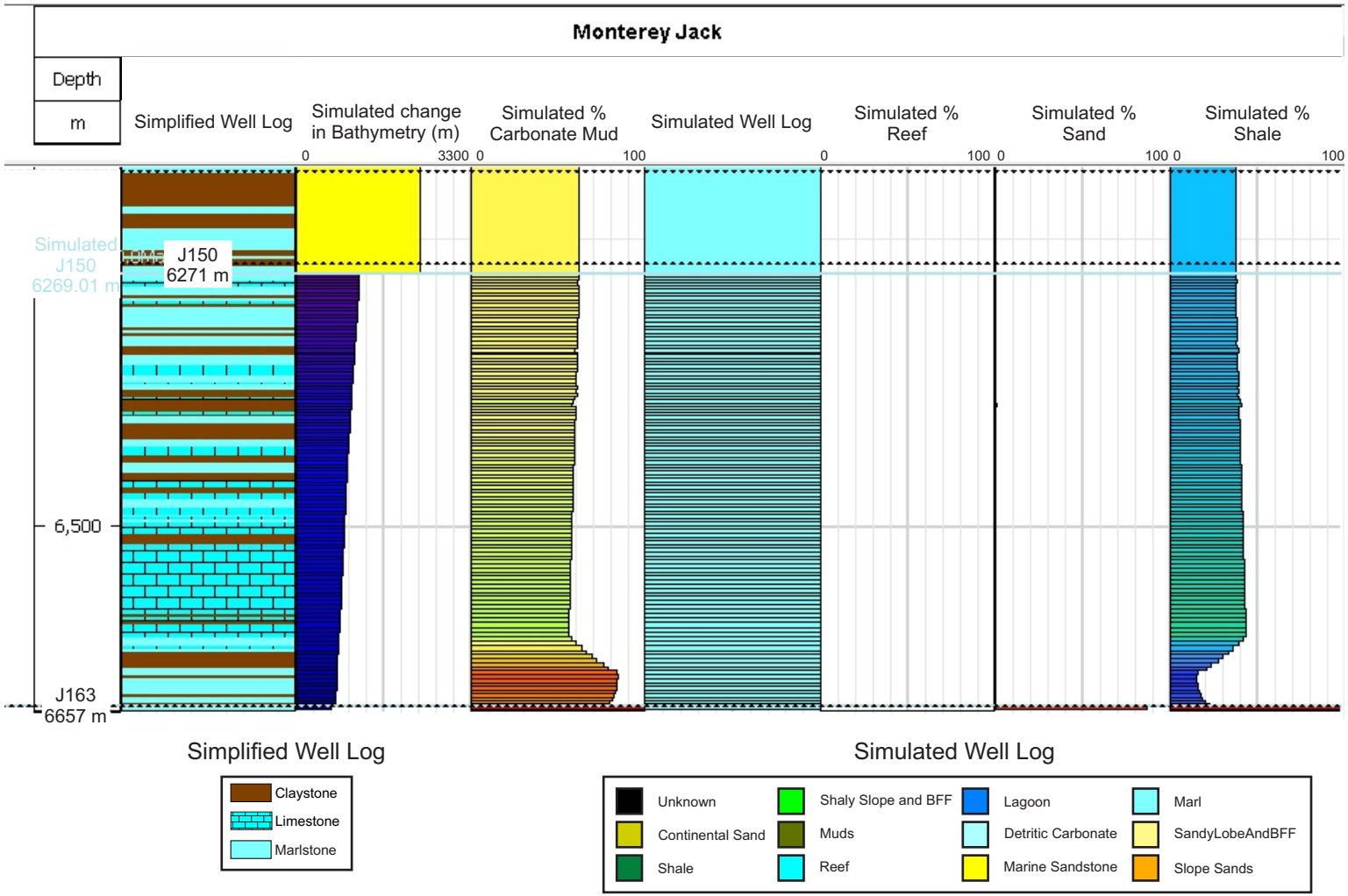


Figure S10.8: Model B (persistent reef) reference case well calibration.

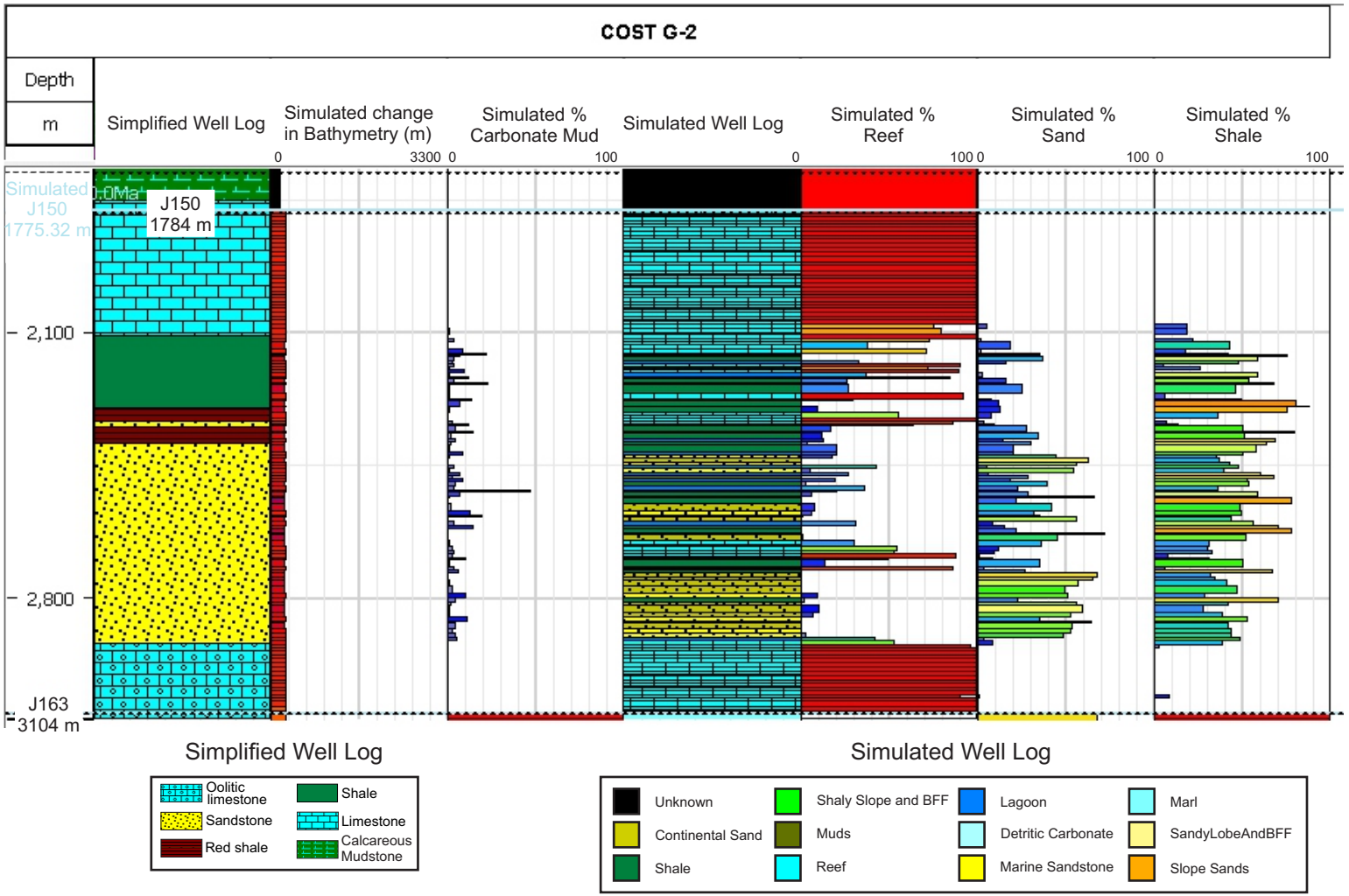


Figure S10.9: Model C (deep basin) reference case well calibration.

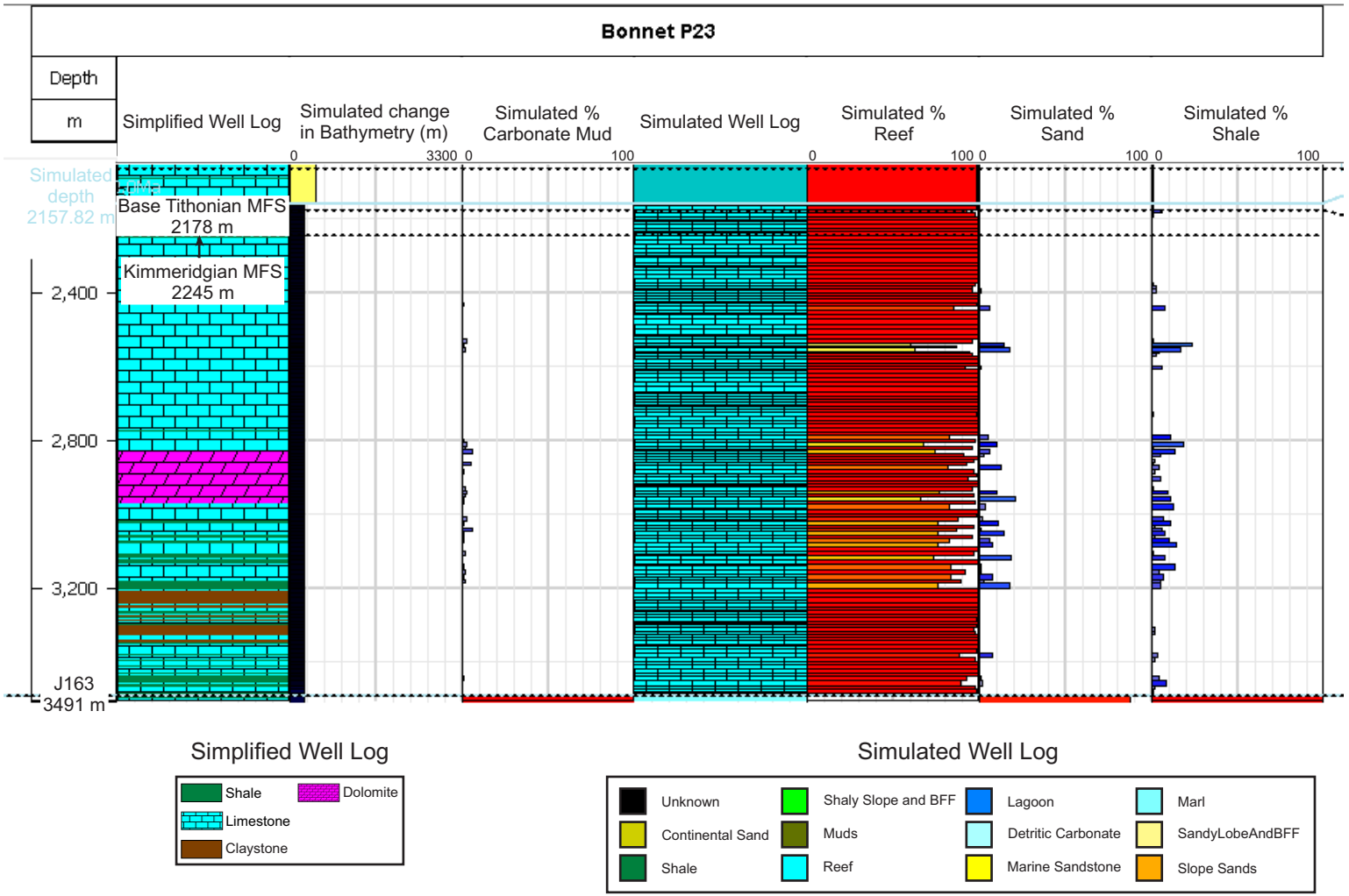


Figure S10.10: Model C (deep basin) reference case well calibration.

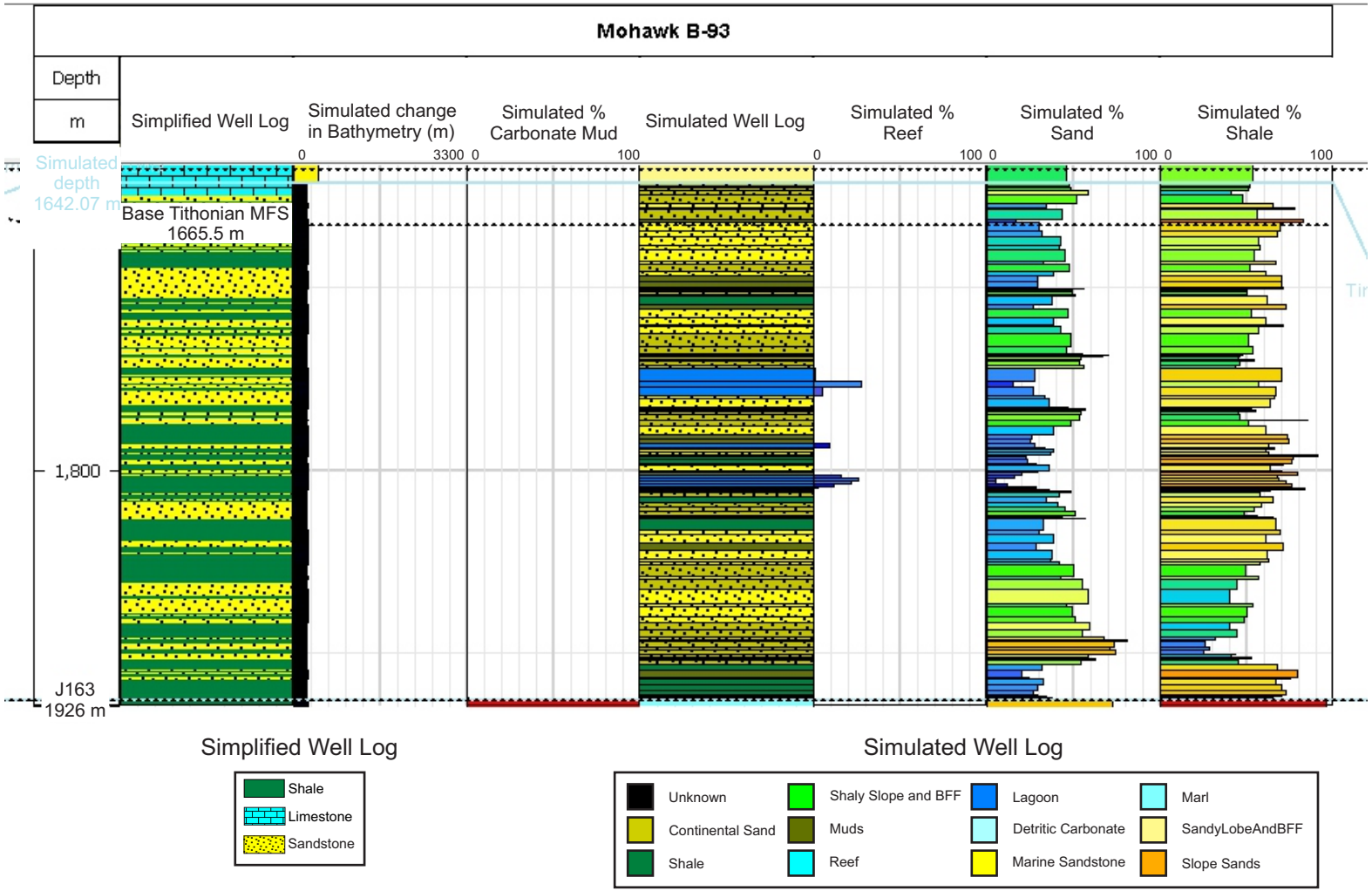


Figure S10.11: Model C (deep basin) reference case well calibration.

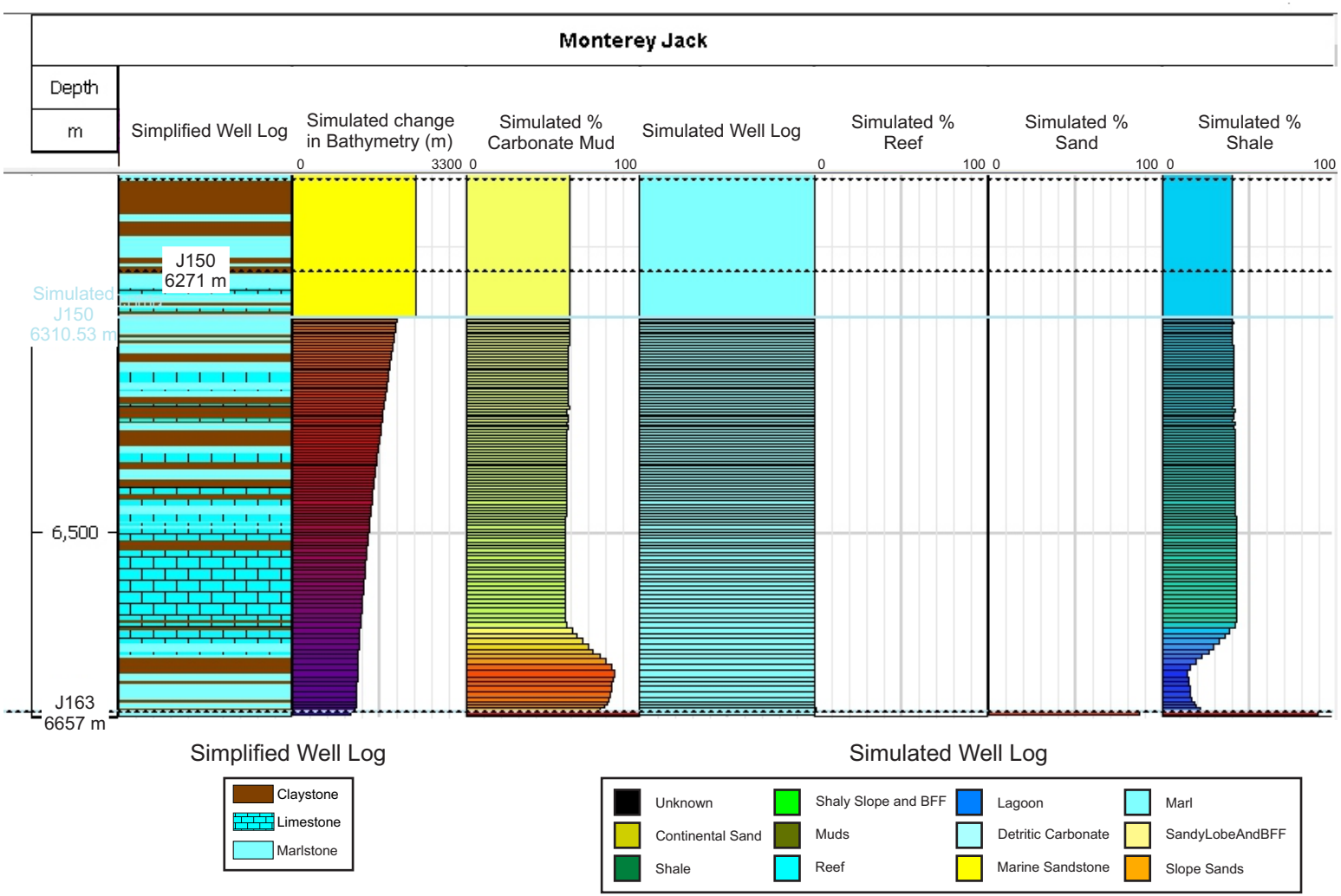


Figure S10.12: Model C (deep basin) reference case well calibration.