



**PROTEZIONE CIVILE**  
 Presidenza del Consiglio dei Ministri  
 Dipartimento della Protezione Civile



CONFERENZA DELLE REGIONI E  
 DELLE PROVINCE AUTONOME

Attuazione dell'articolo 11 della legge 24 giugno 2009, n.77

# MICROZONAZIONE SISMICA

## ALLEGATO 14 VERIFICHE A LIQUEFAZIONE COMUNE DI ARGENTA LIVELLO 3

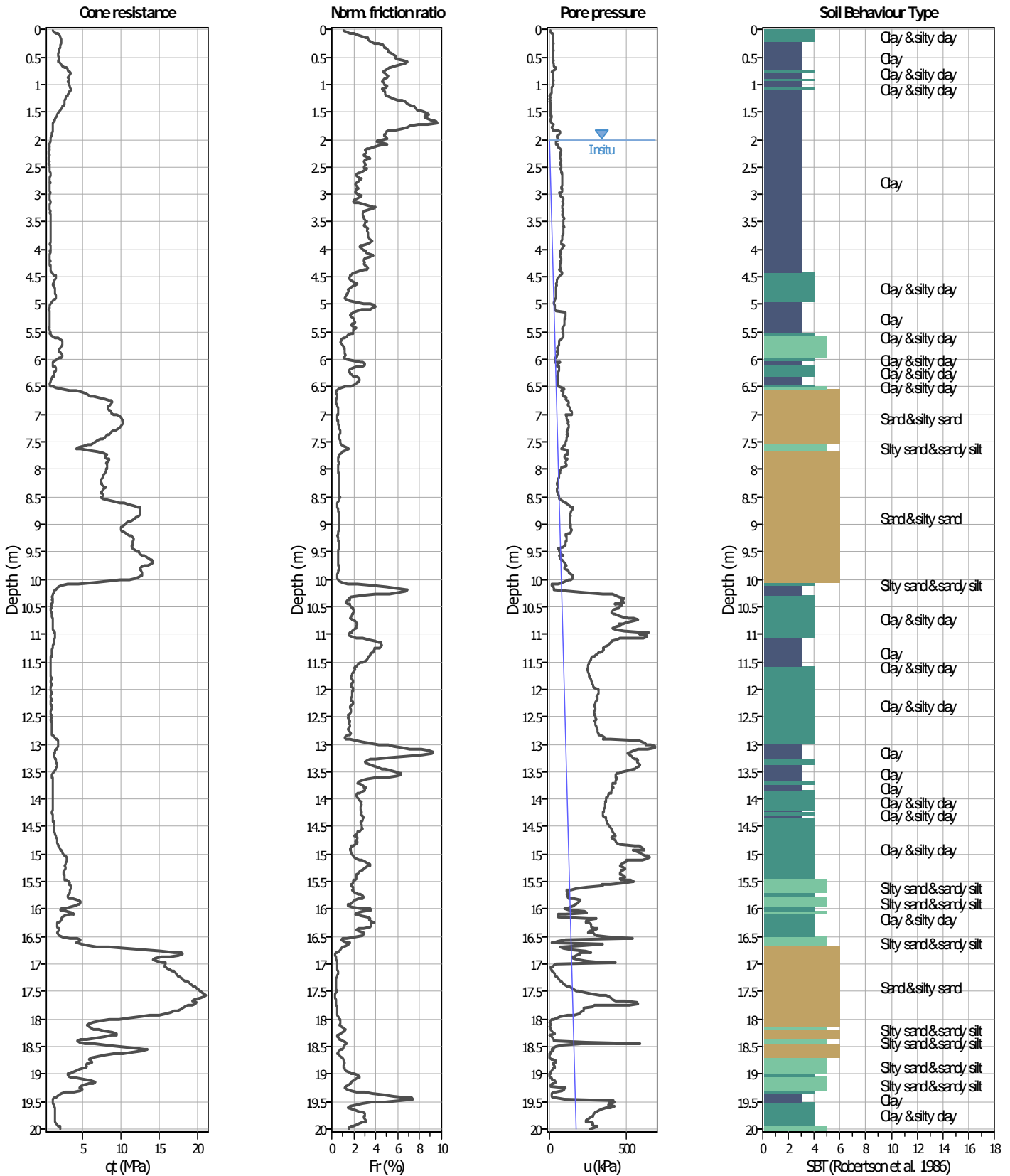
Regione Emilia-Romagna

Unione Valli e Delizie

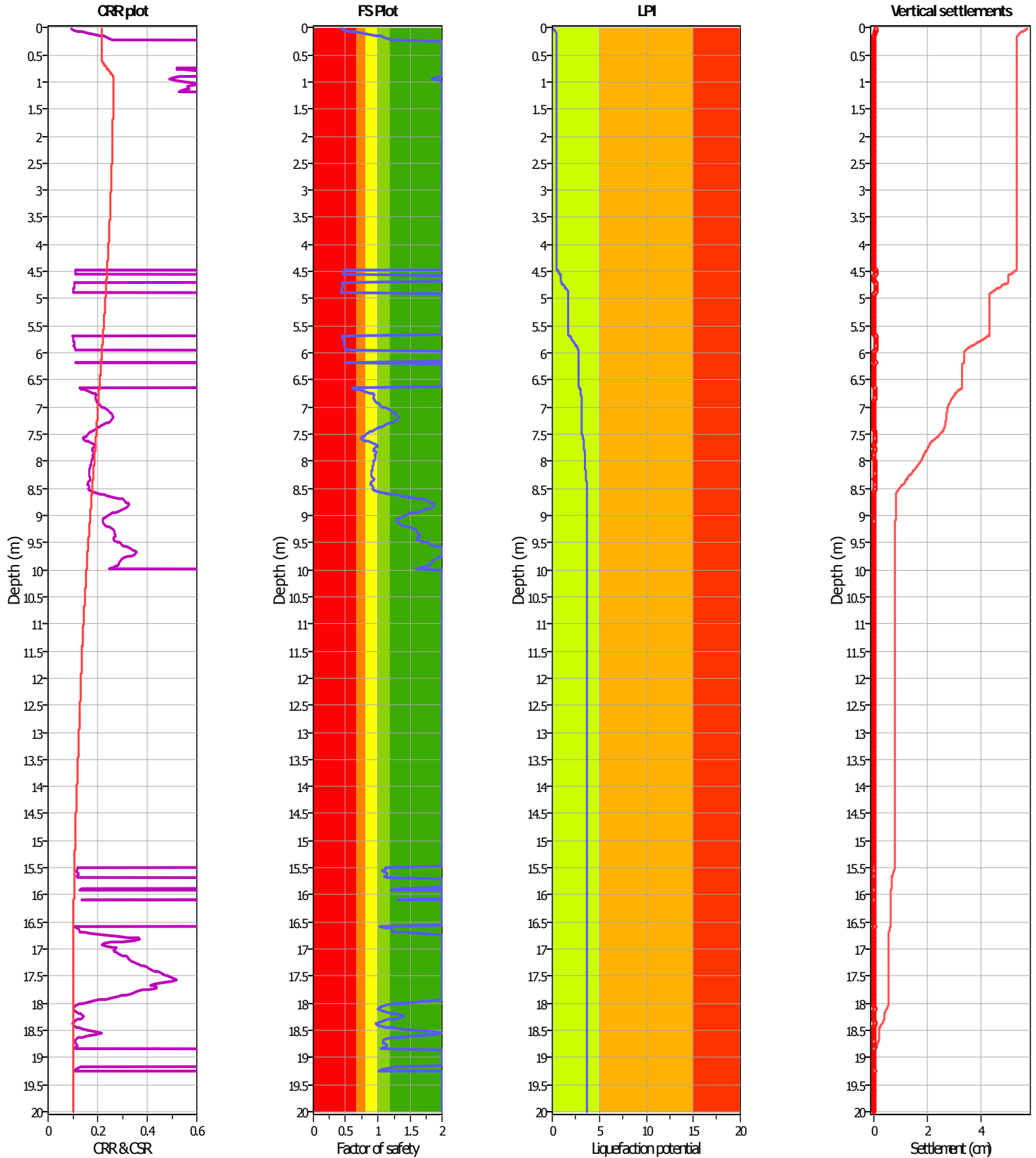
Comuni di Argenta, Ostellato e Portomaggiore



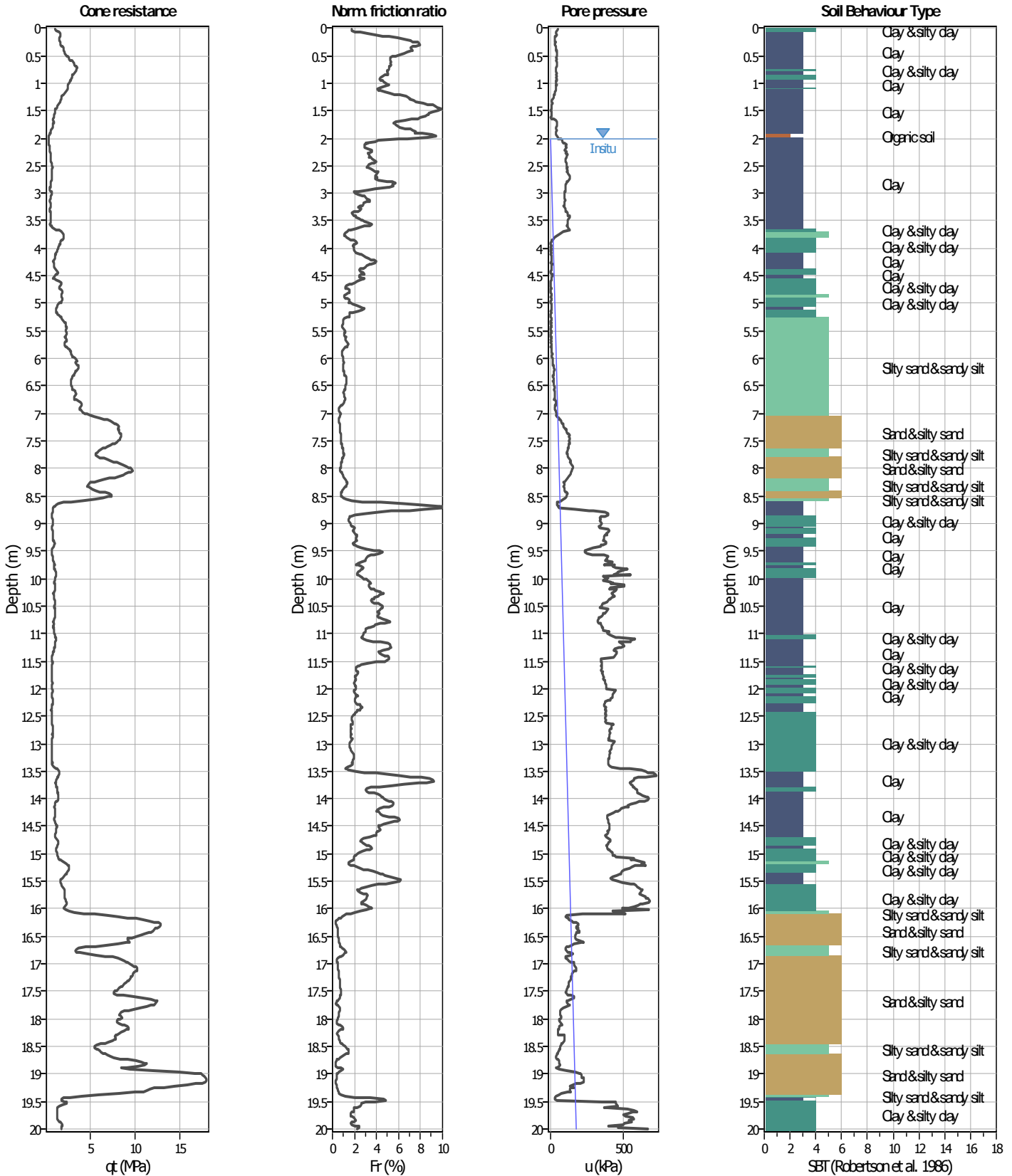
<p>Regione</p> <p>Emilia-Romagna</p>	<p>Soggetto realizzatore</p> <p><b>RAGGRUPPAMENTO TEMPORANEO DI PROFESSIONISTI</b>  <b>Mandataria</b></p>  <p>Direzione tecnica  Dott. Geol. Carlo Caleffi  Dott. Geol. Francesco Cerutti</p> <p>Mandante  Dott. Geol. Stefano Castagnetti</p> <p>Collaboratori  Dott. Geol. Matteo Baisi  Dott. Geol. Marco Baldi</p>	<p>Data</p> <p>Luglio 2017</p>
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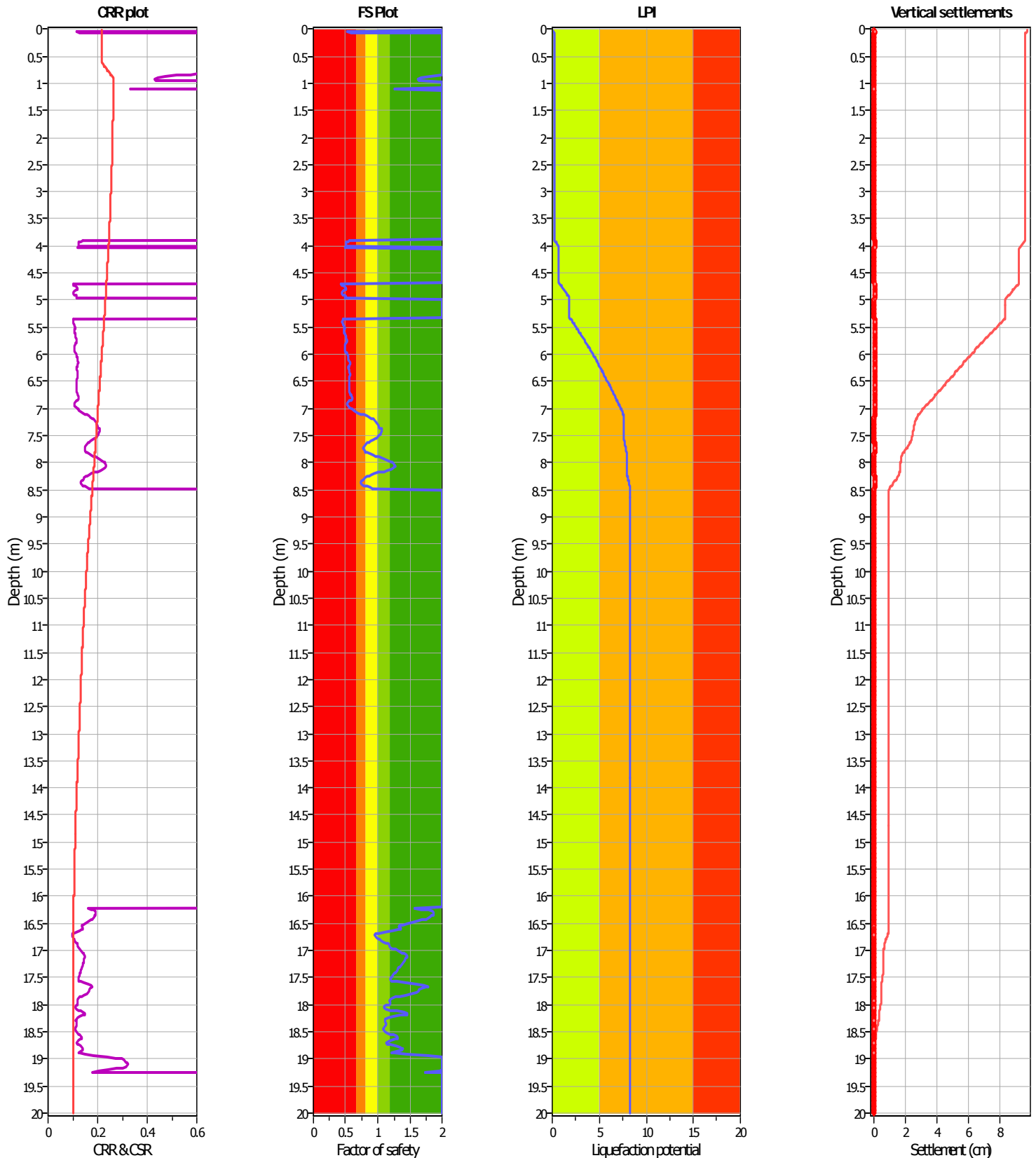
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Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



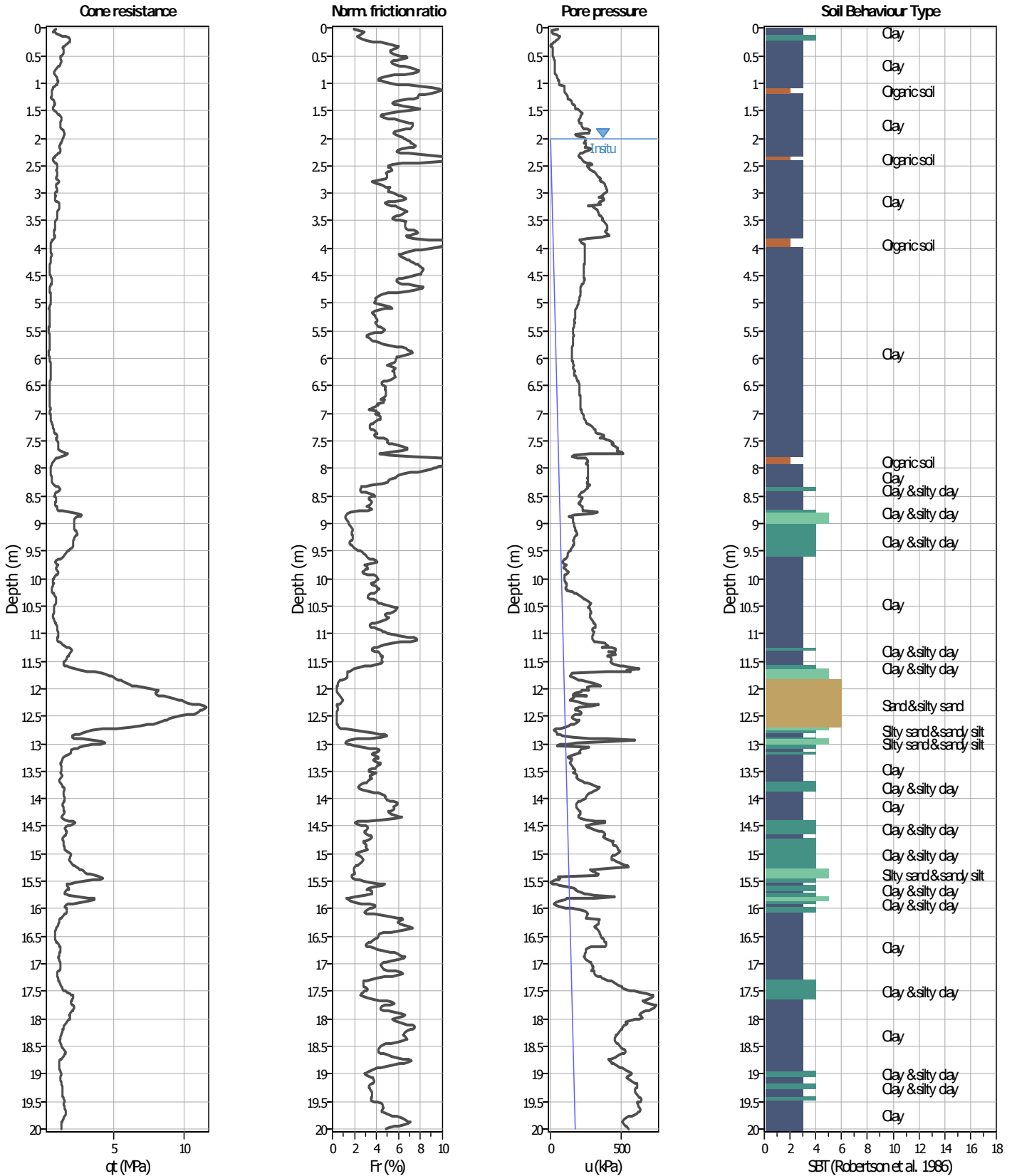
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Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



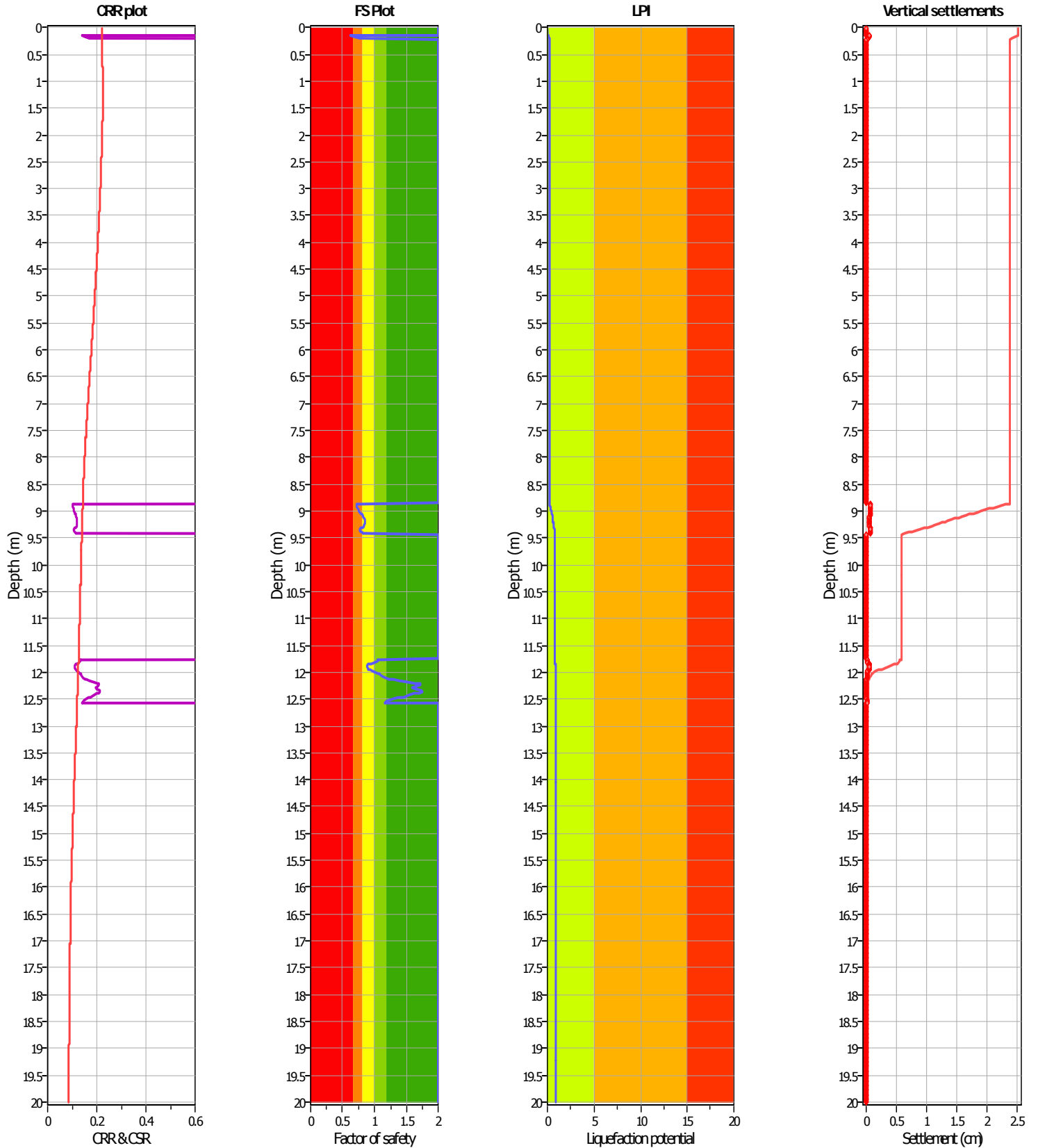
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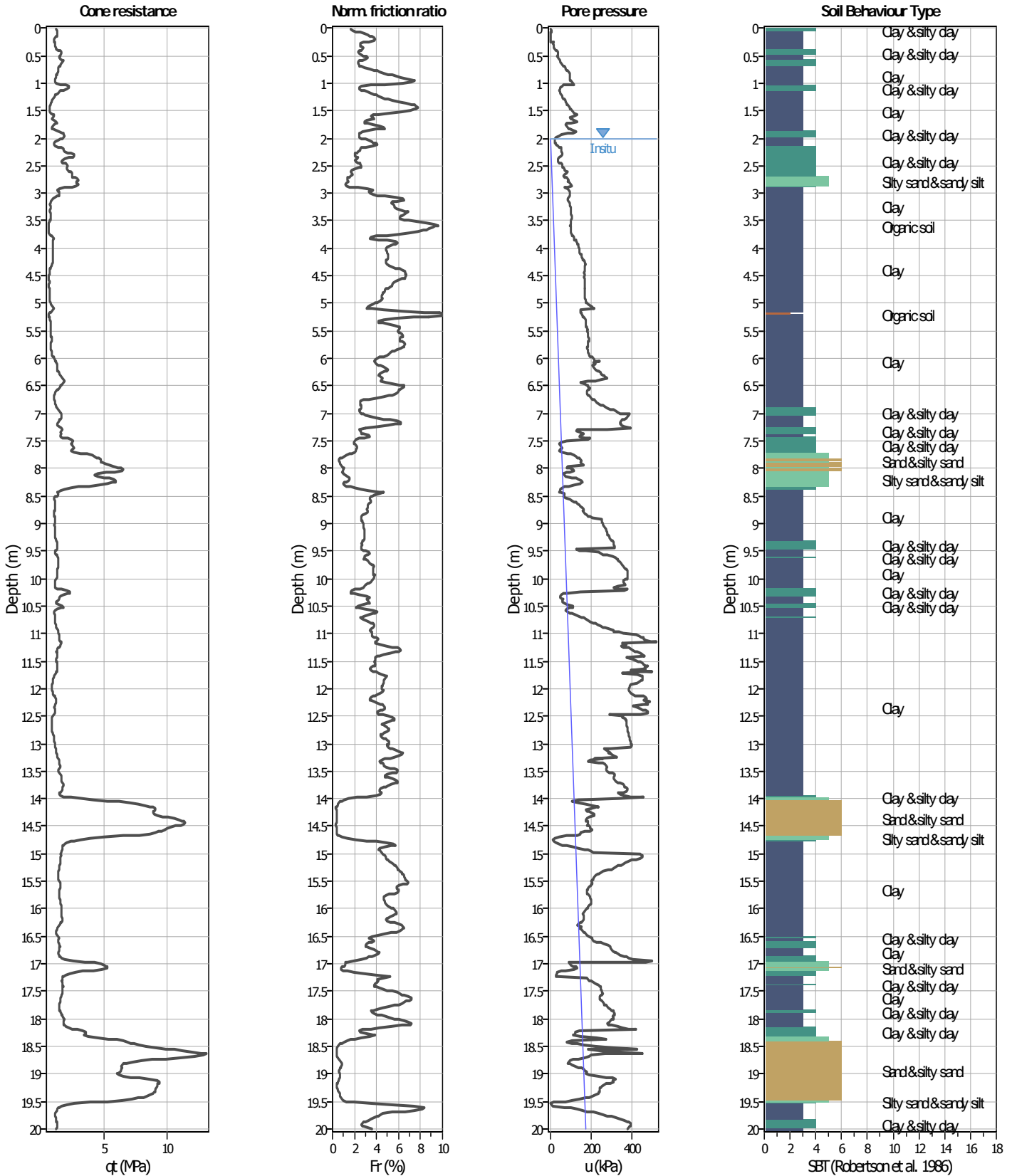


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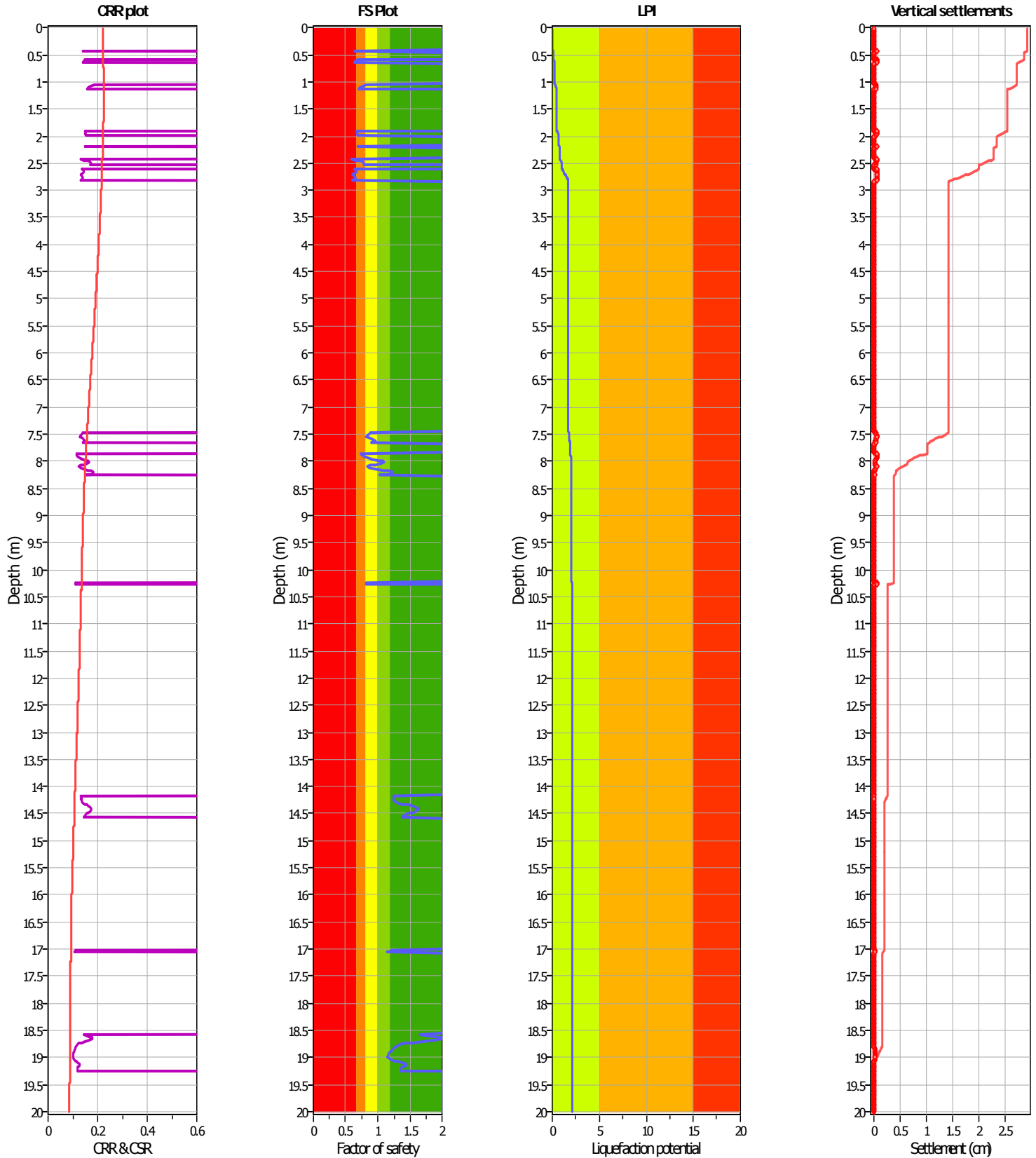
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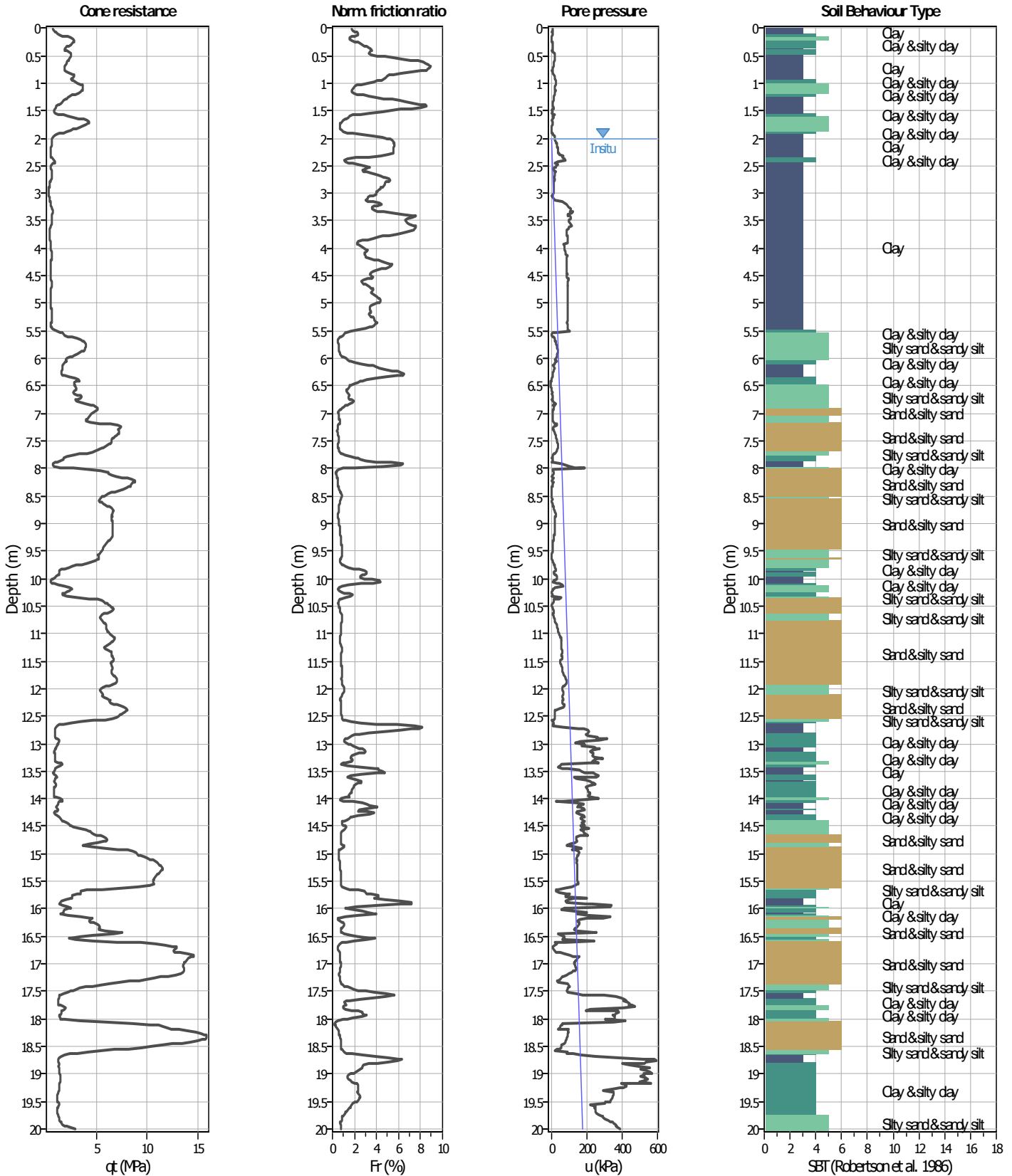


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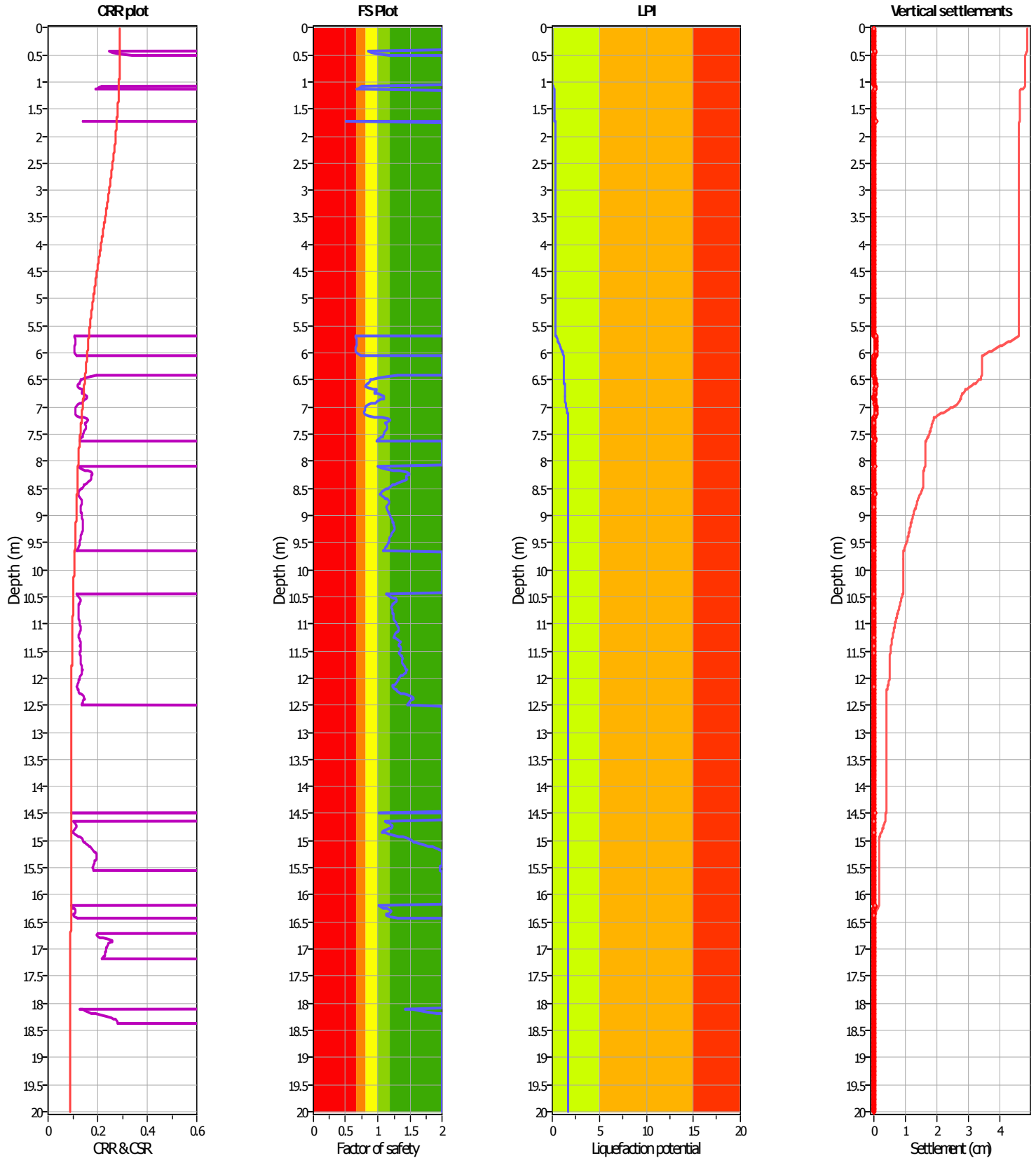




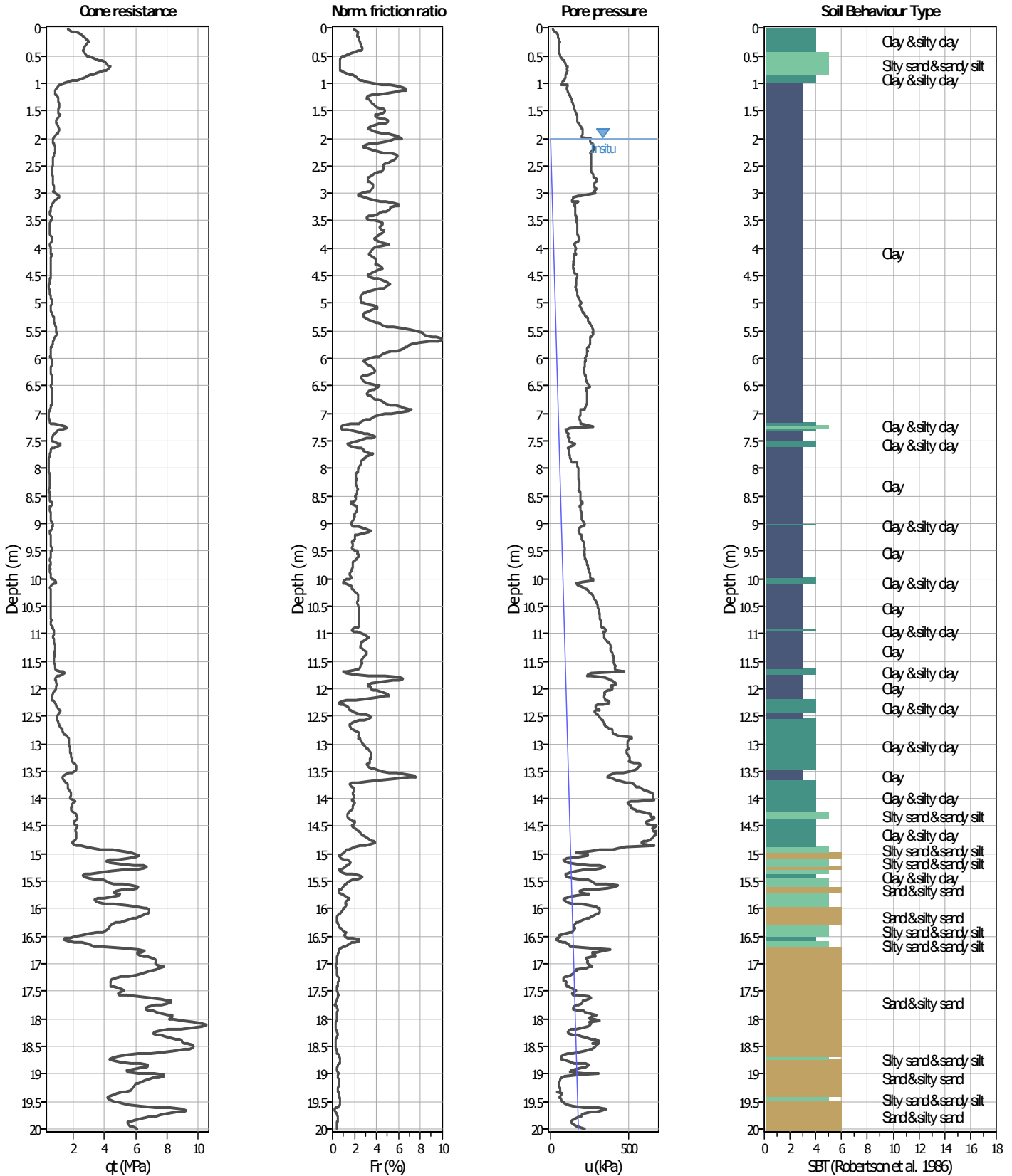
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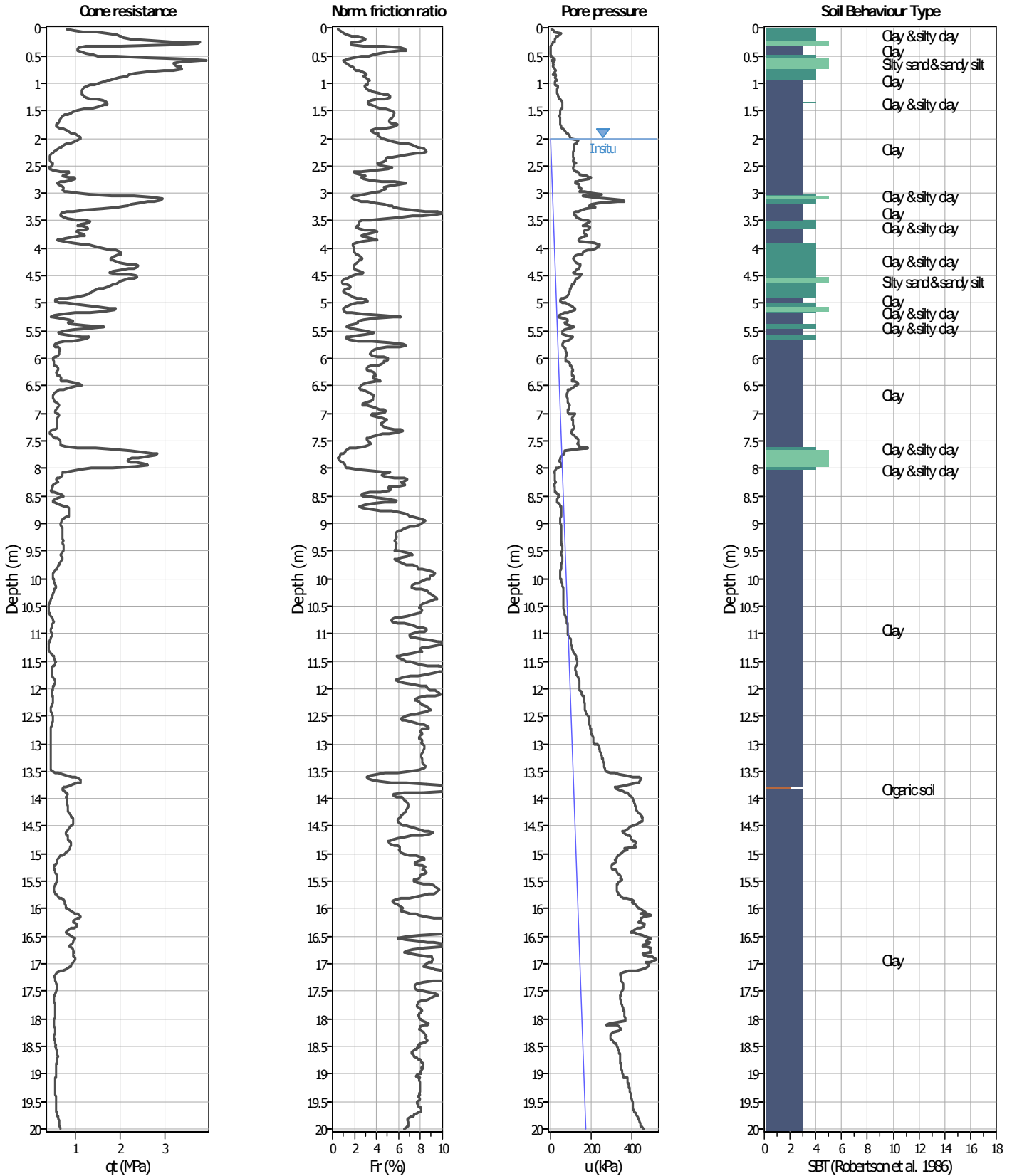
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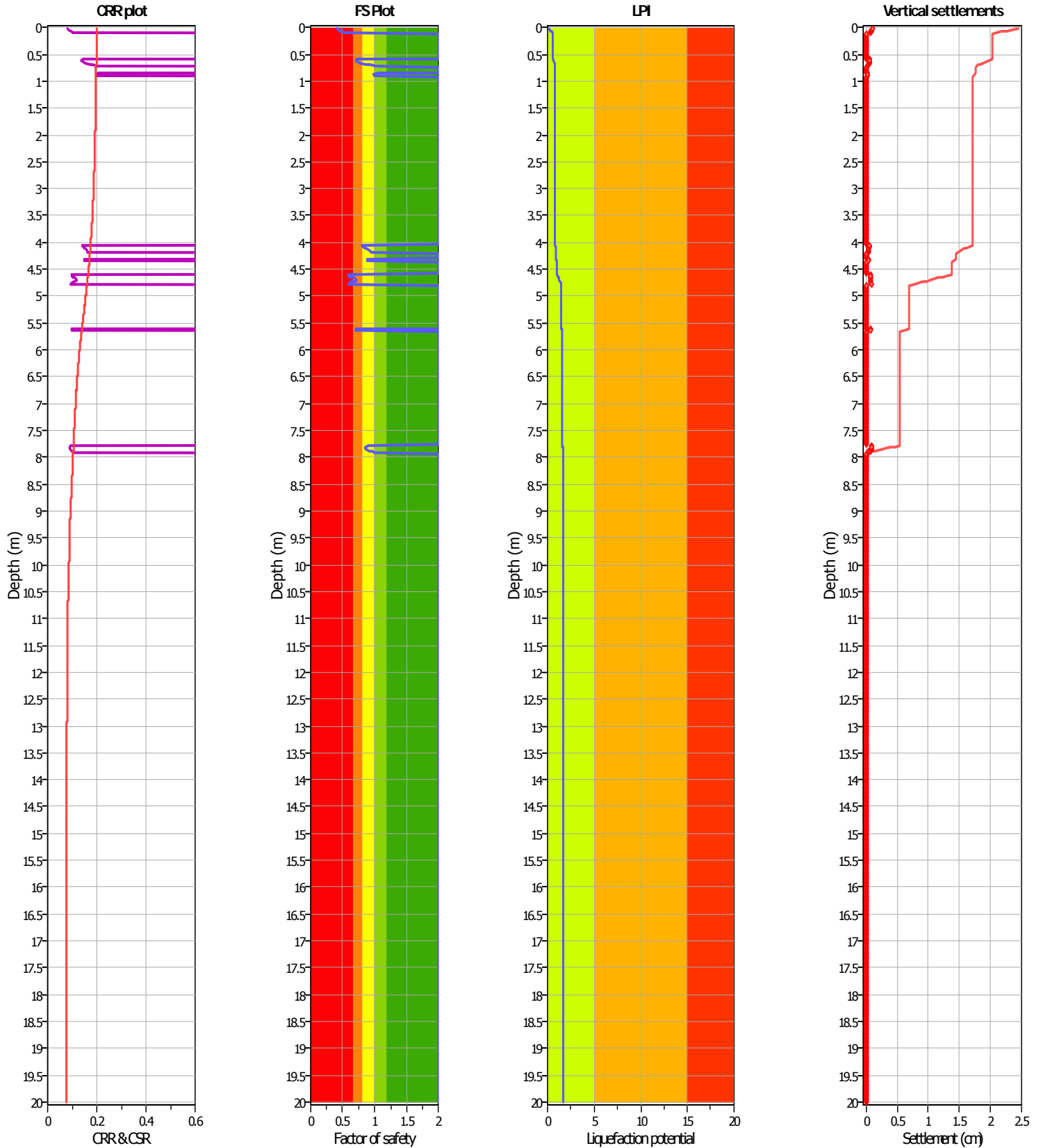
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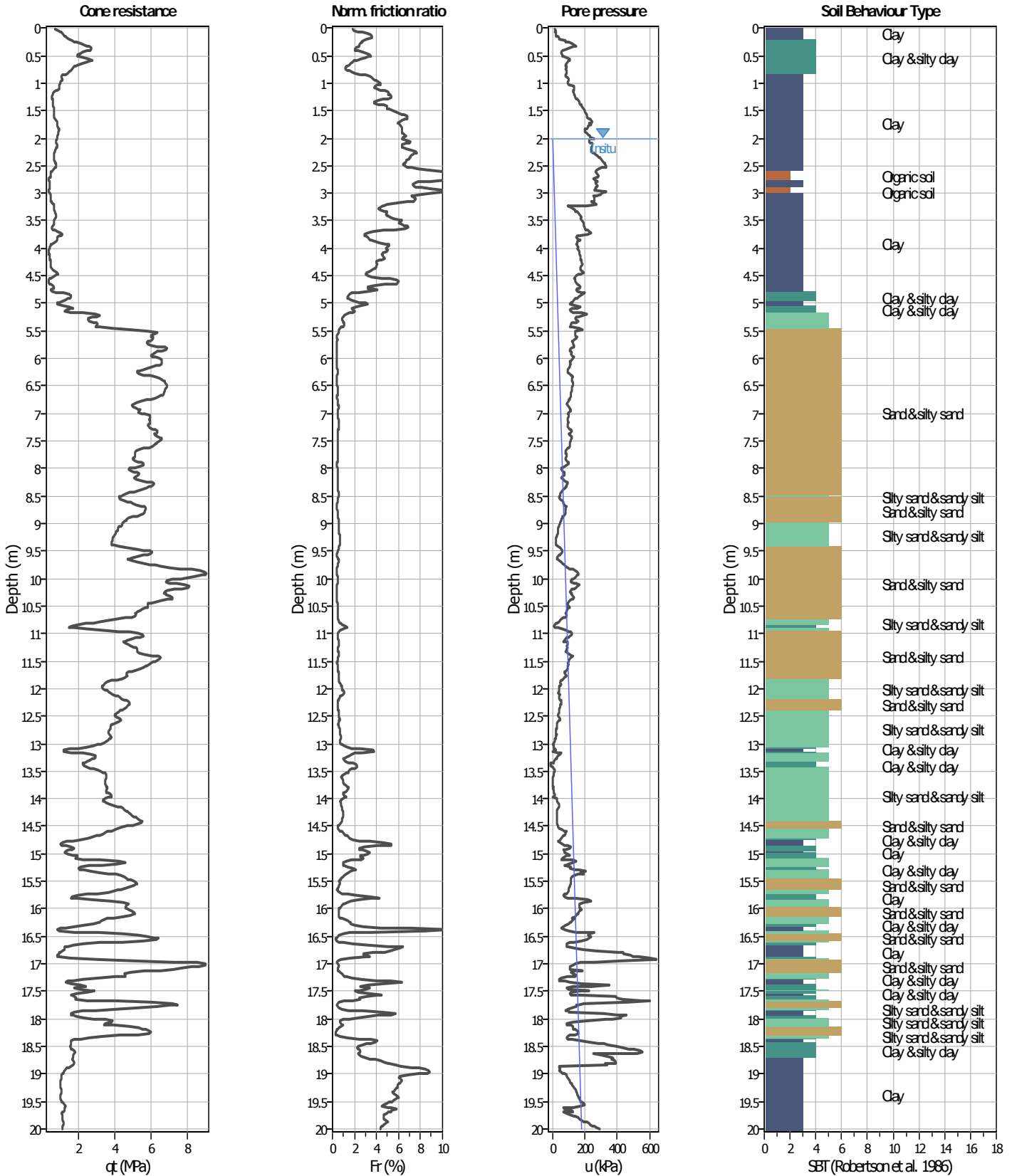


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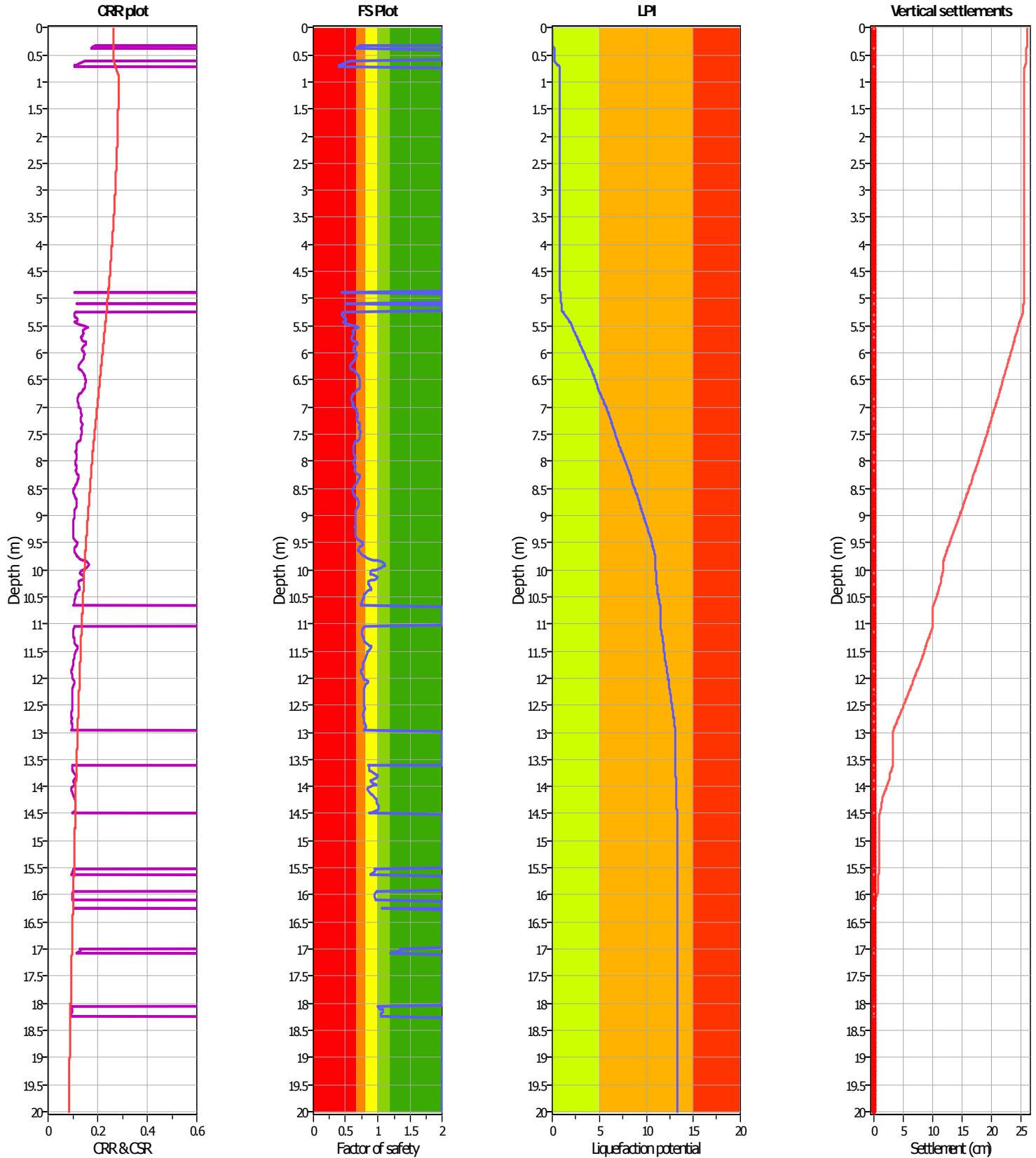


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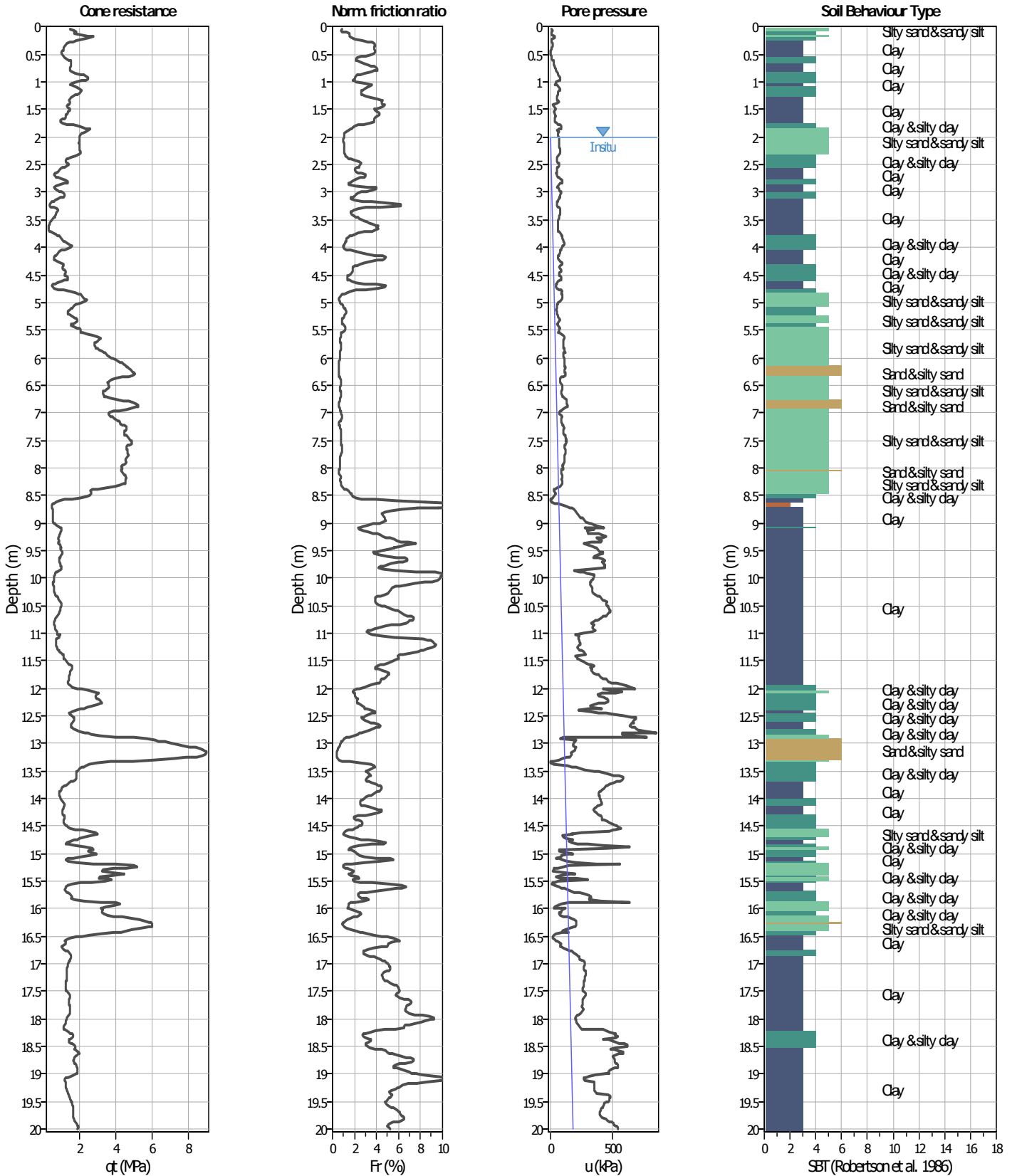




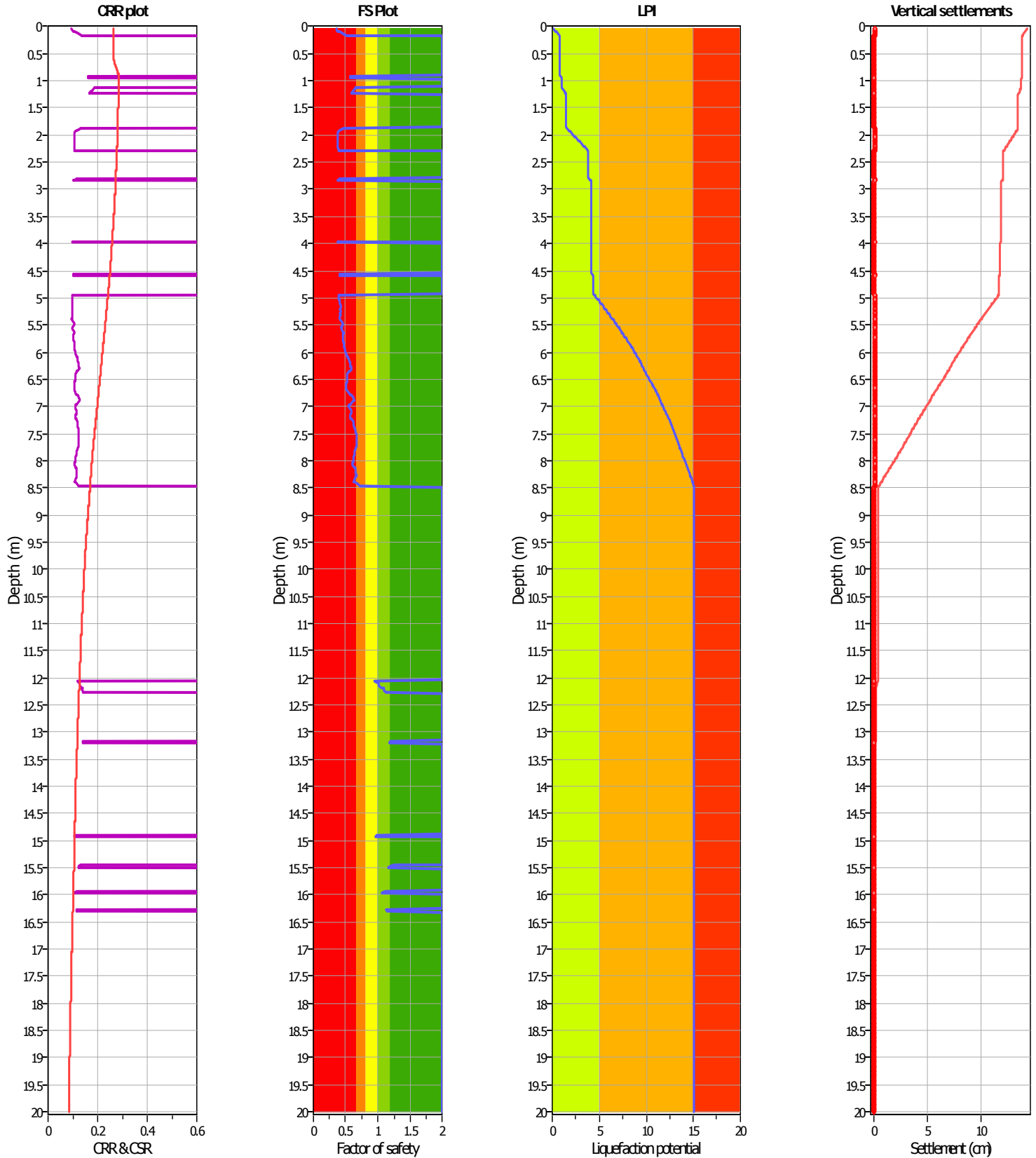
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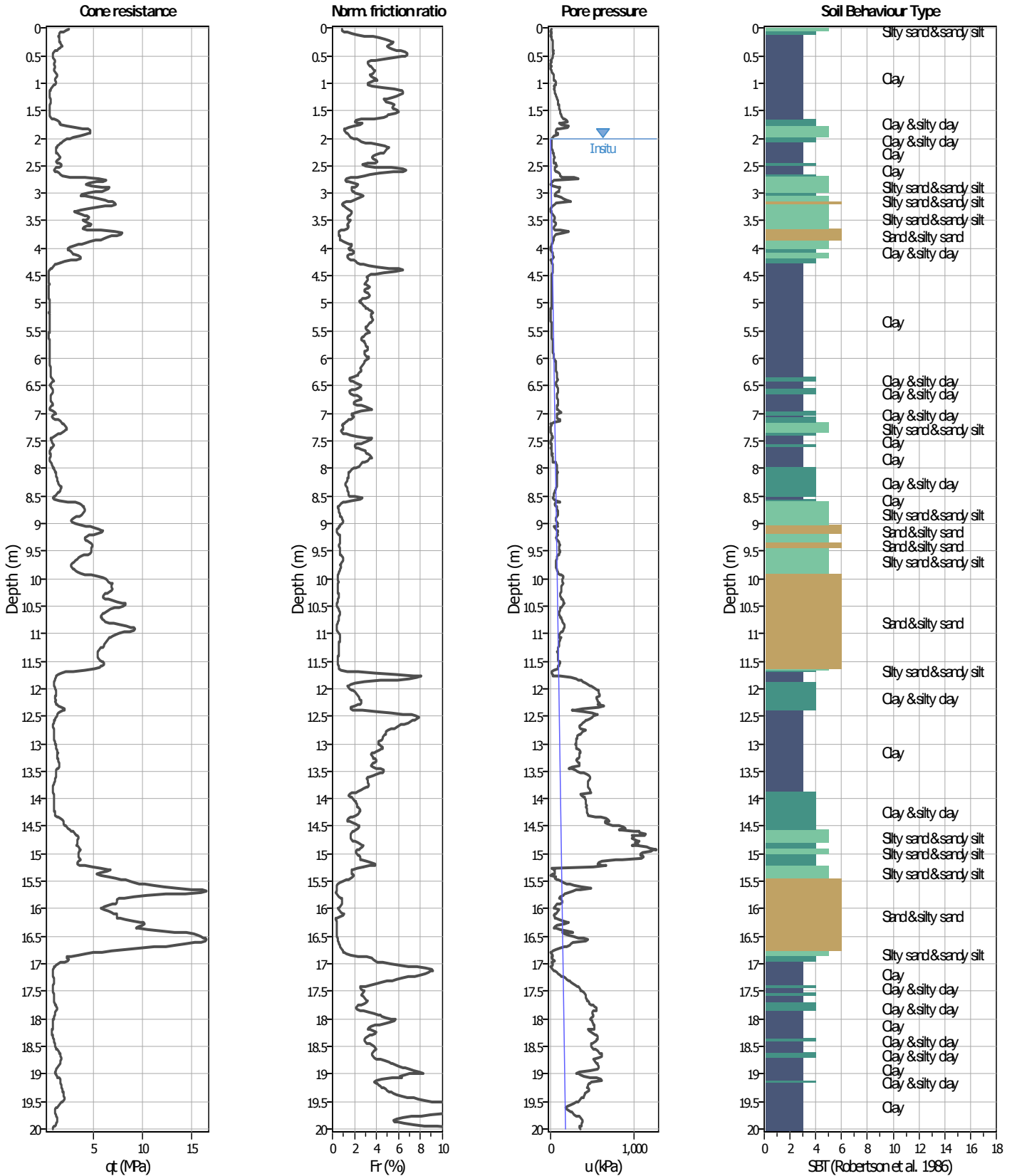
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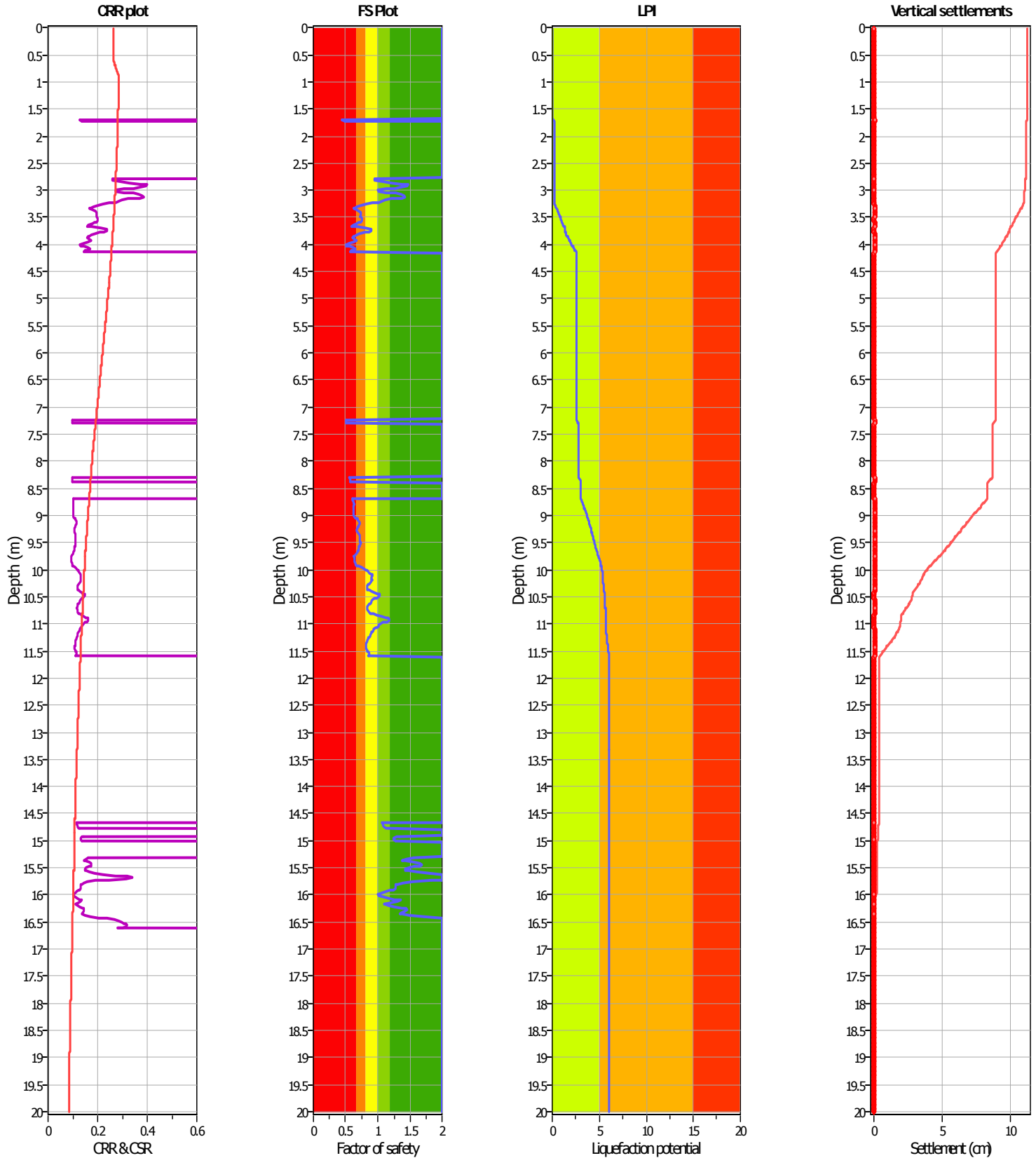
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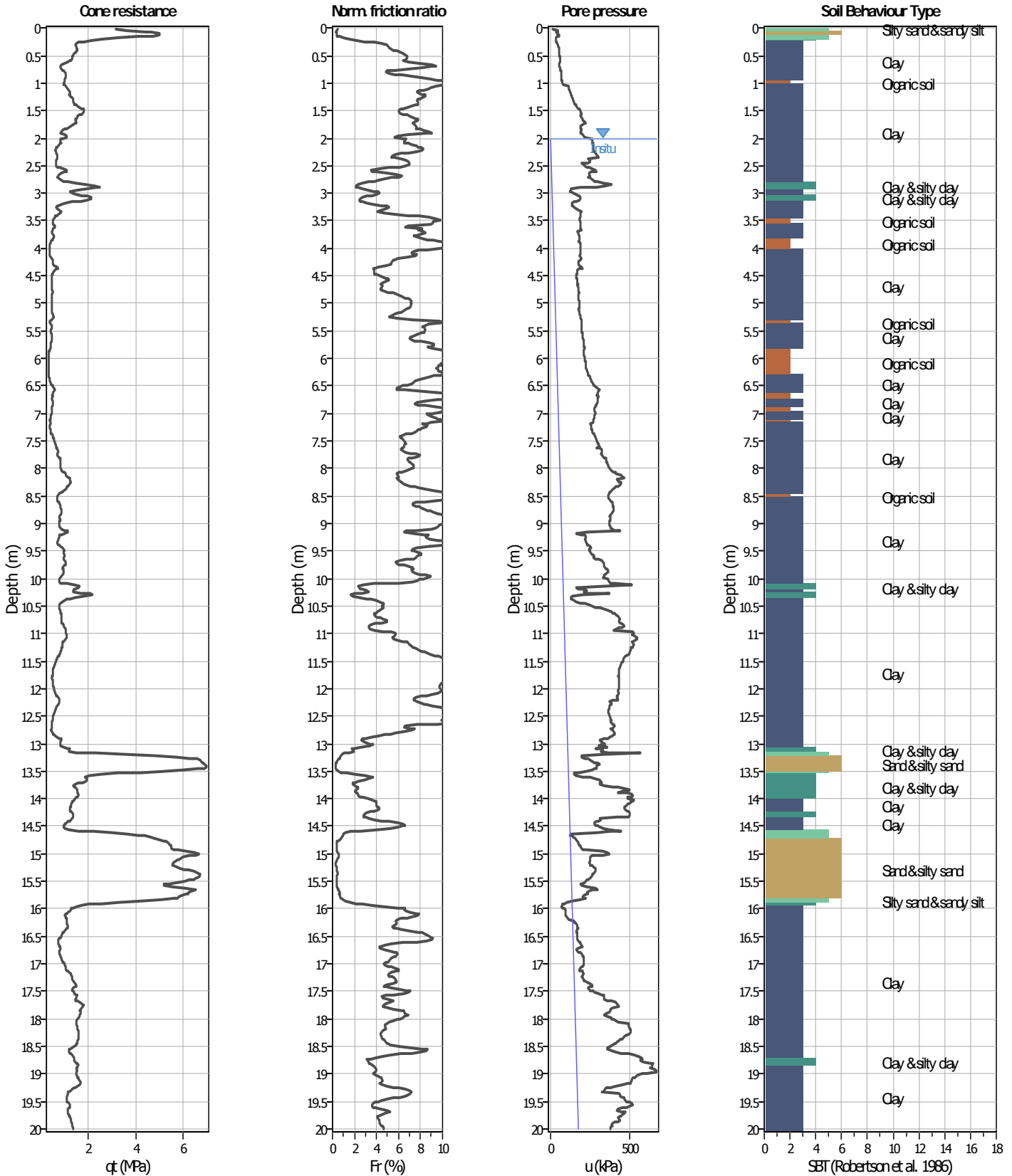
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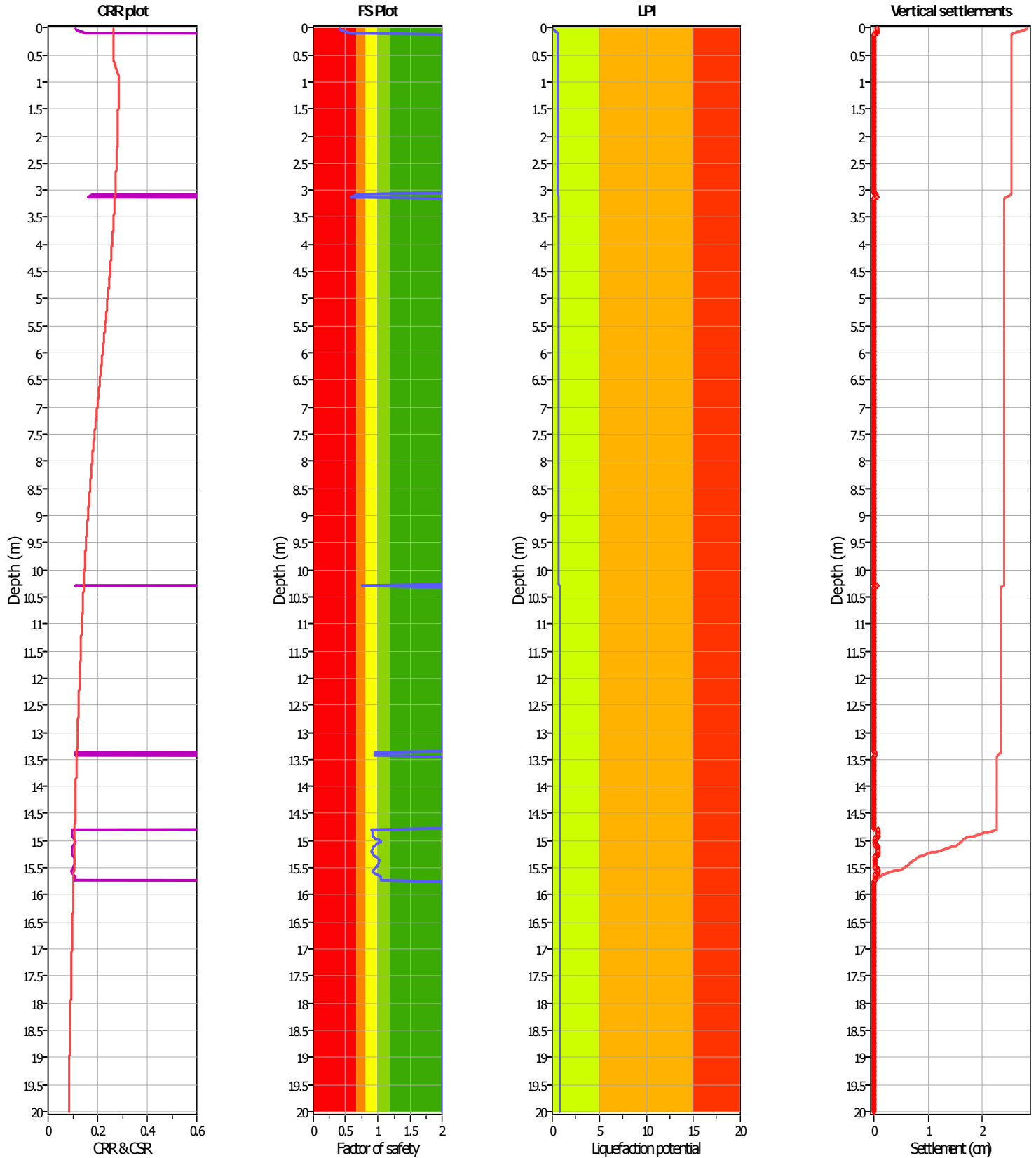


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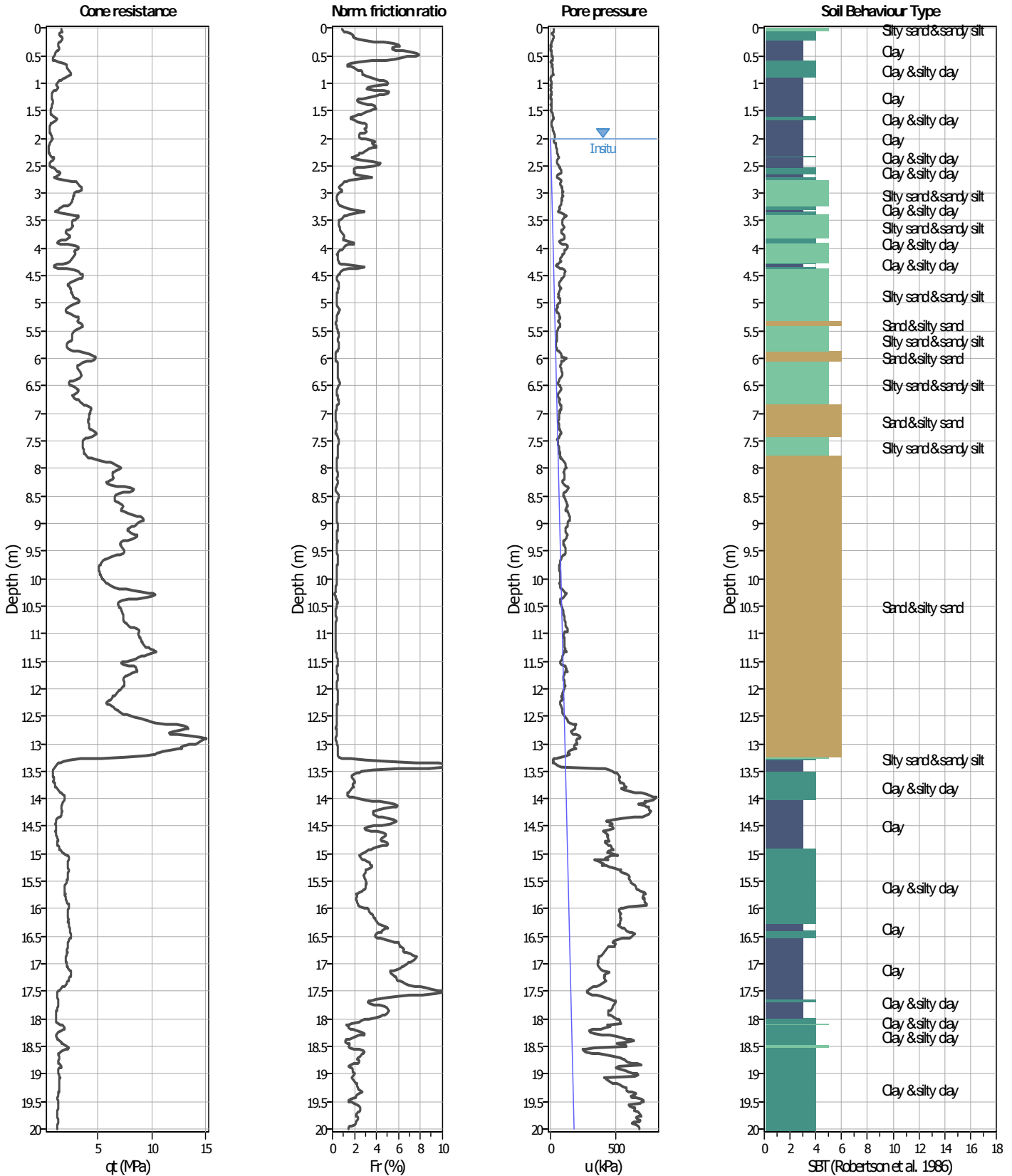


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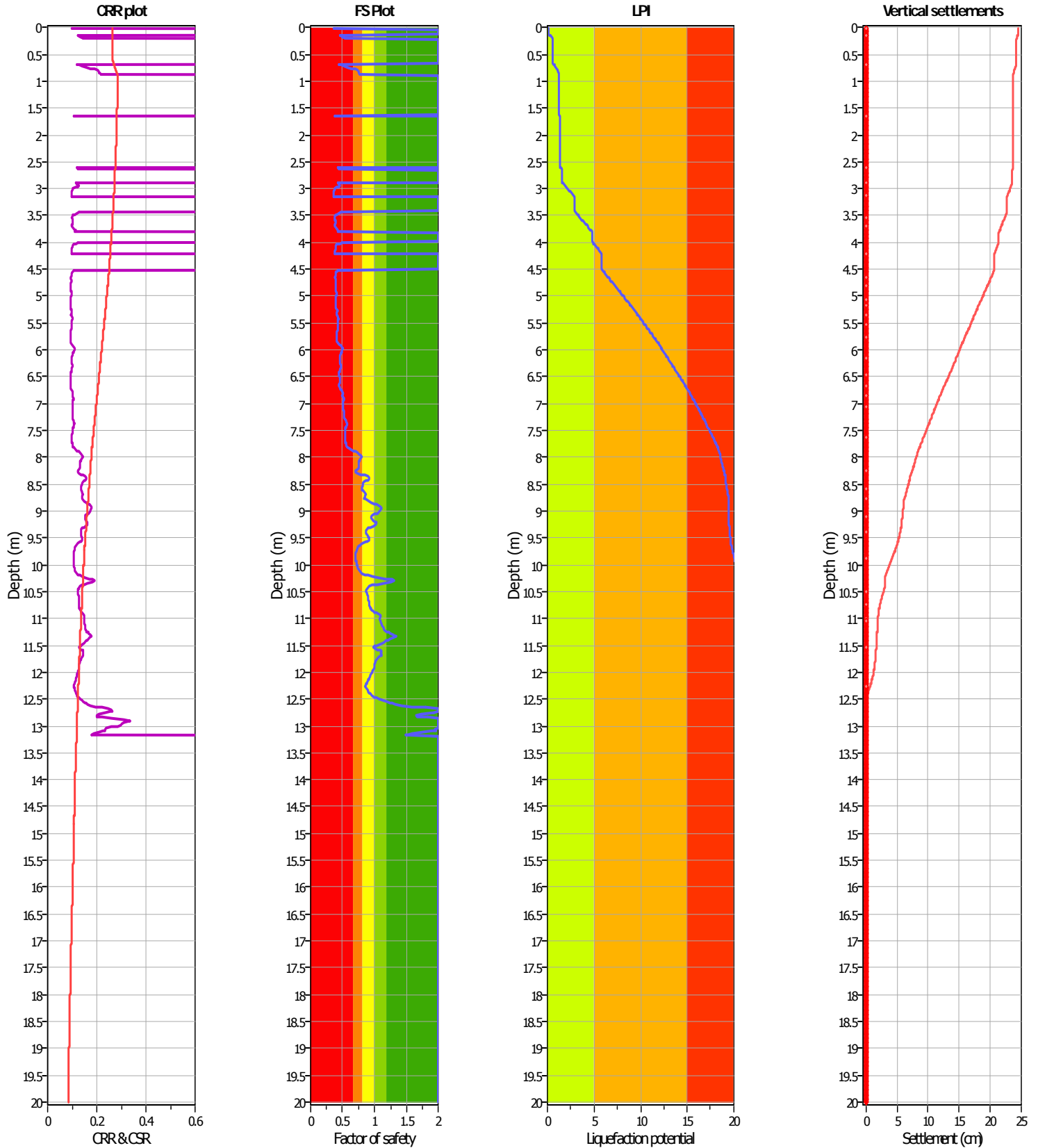




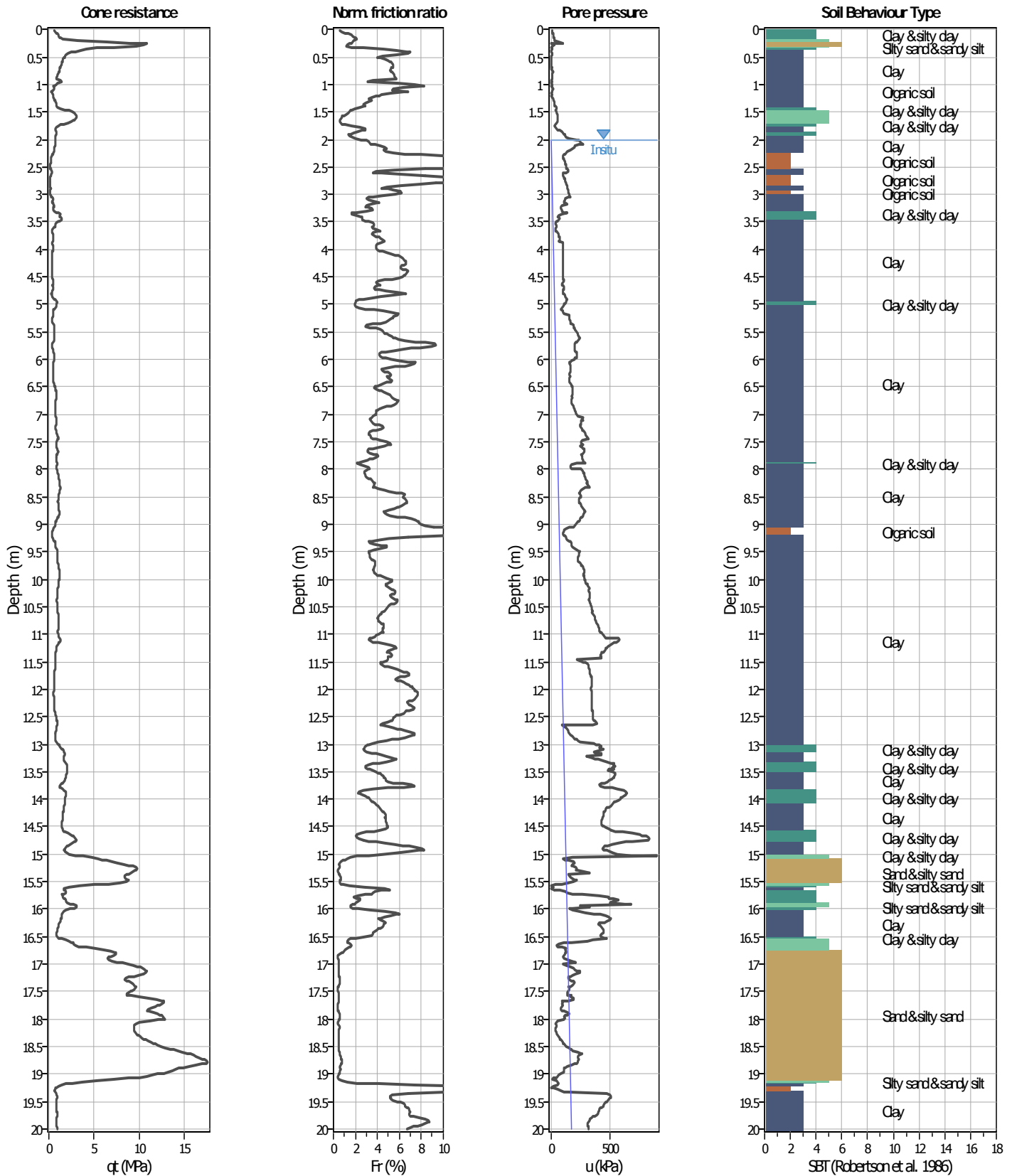
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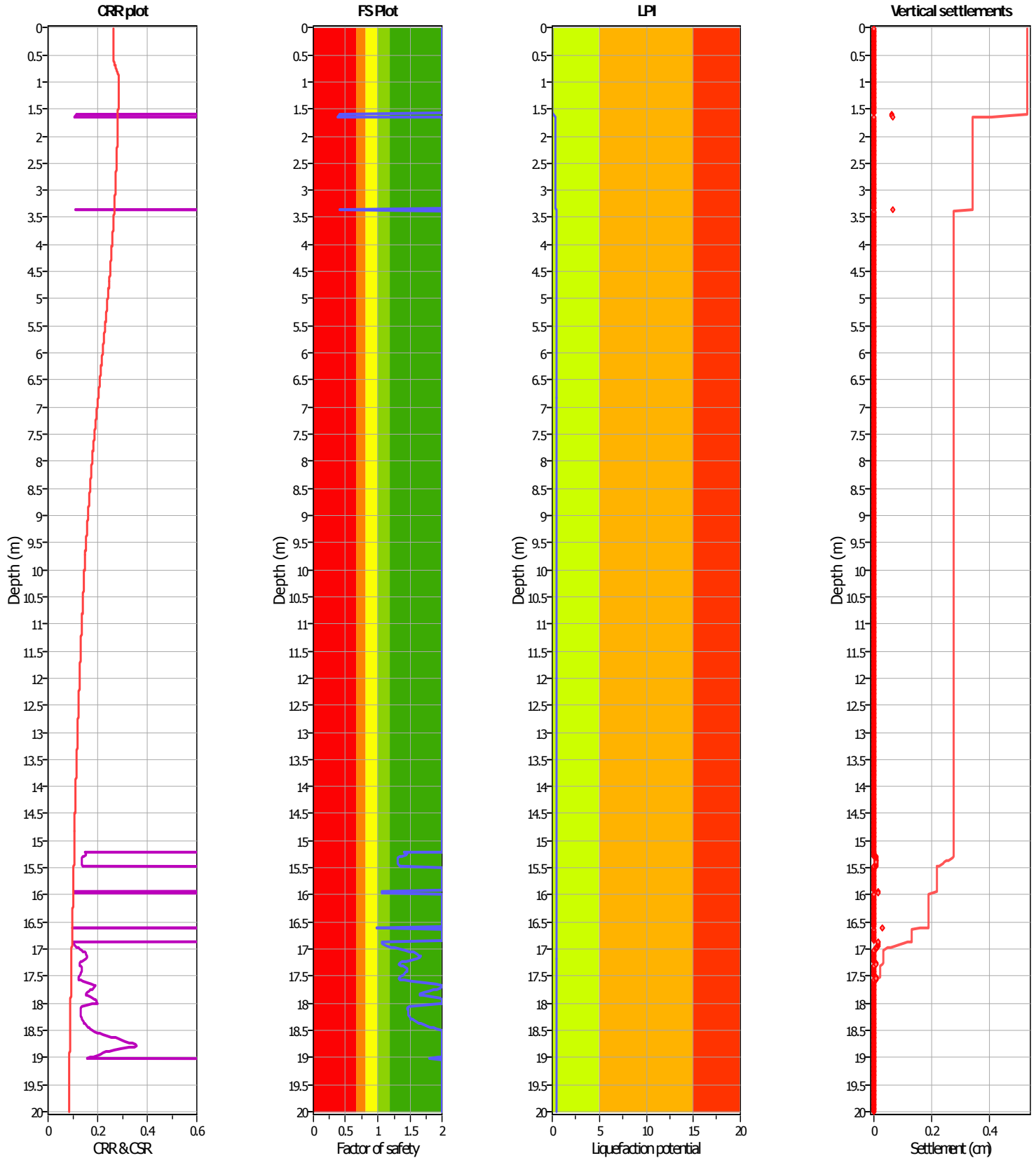
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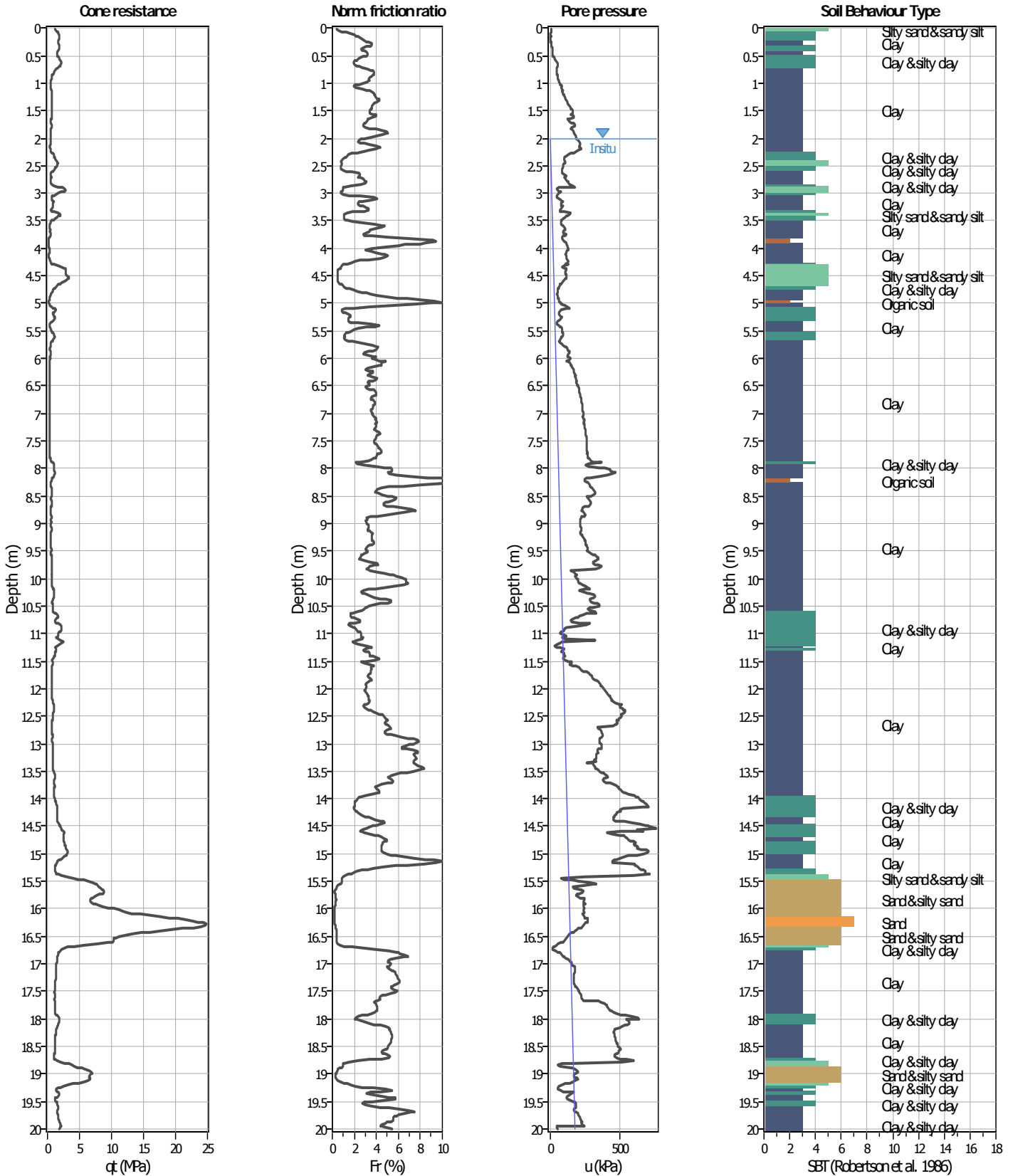
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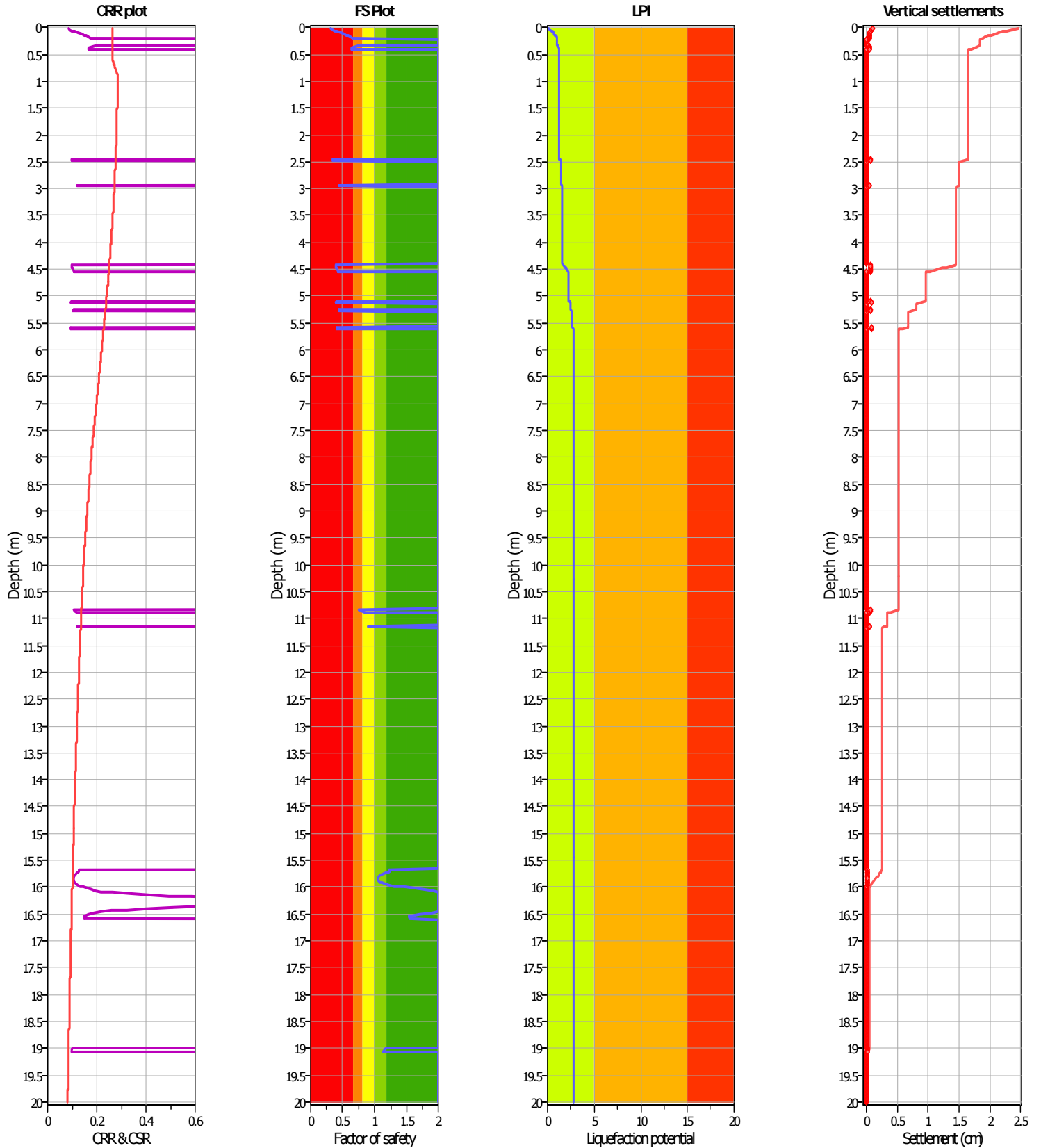
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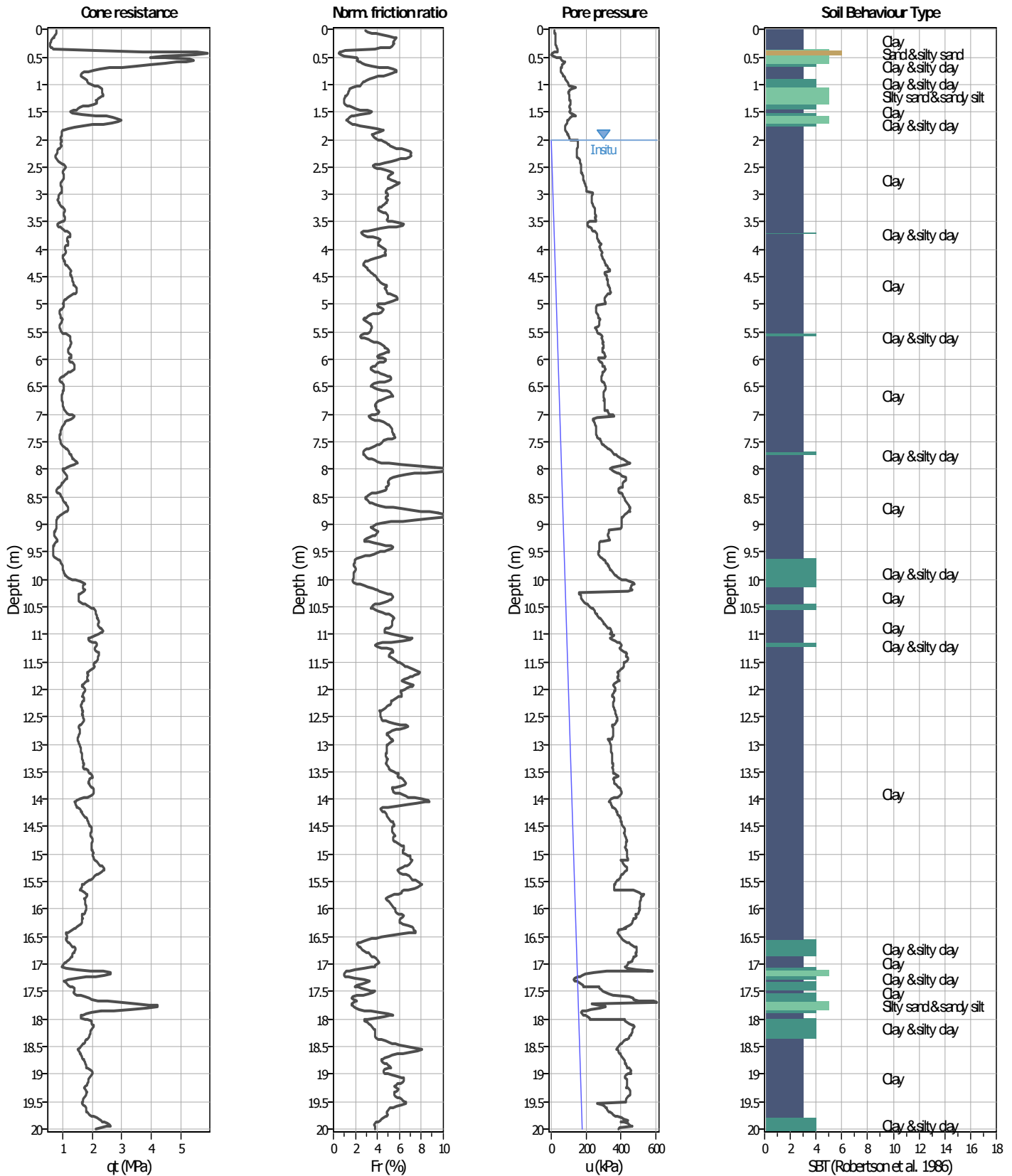


Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based

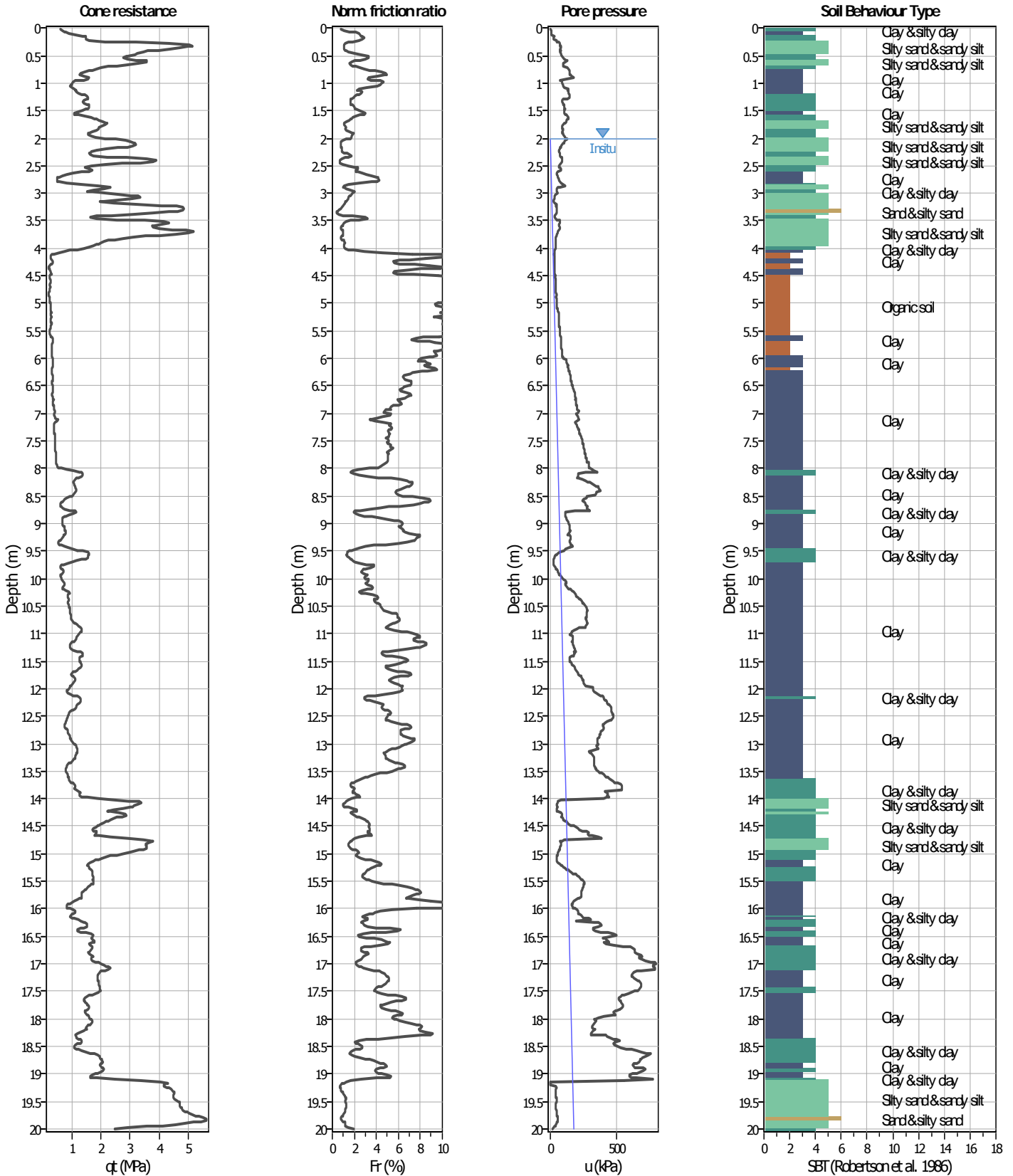




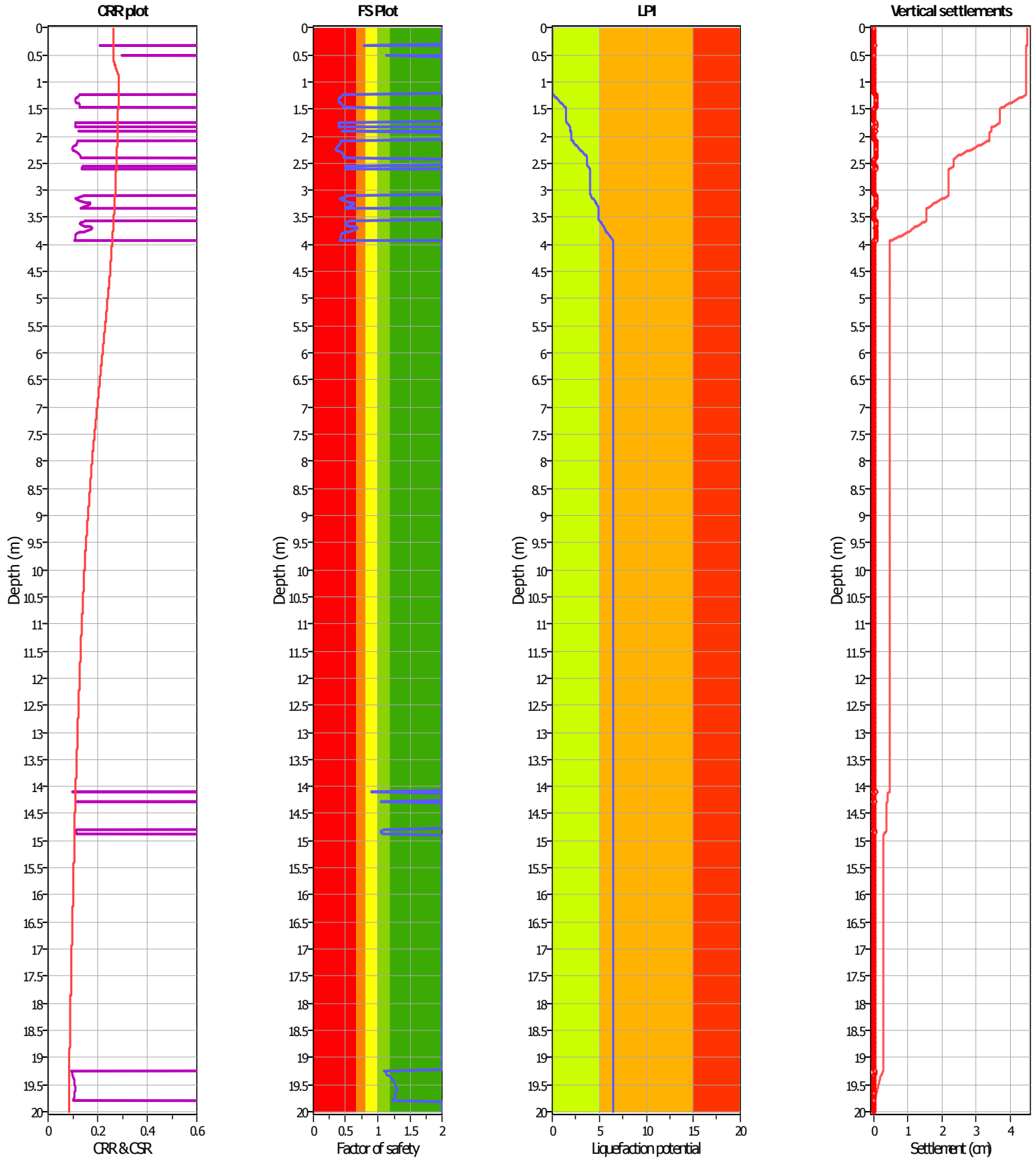
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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



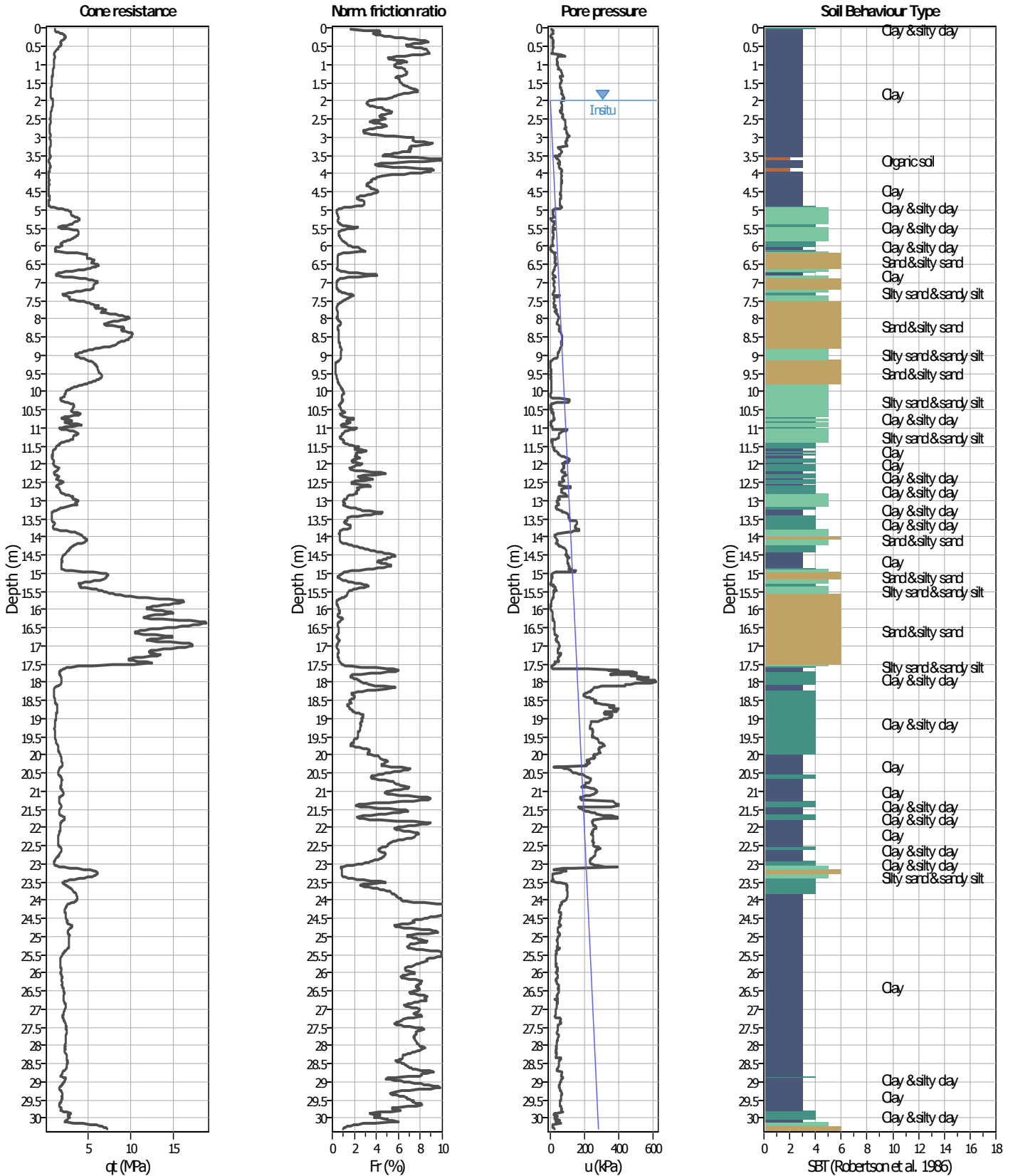
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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



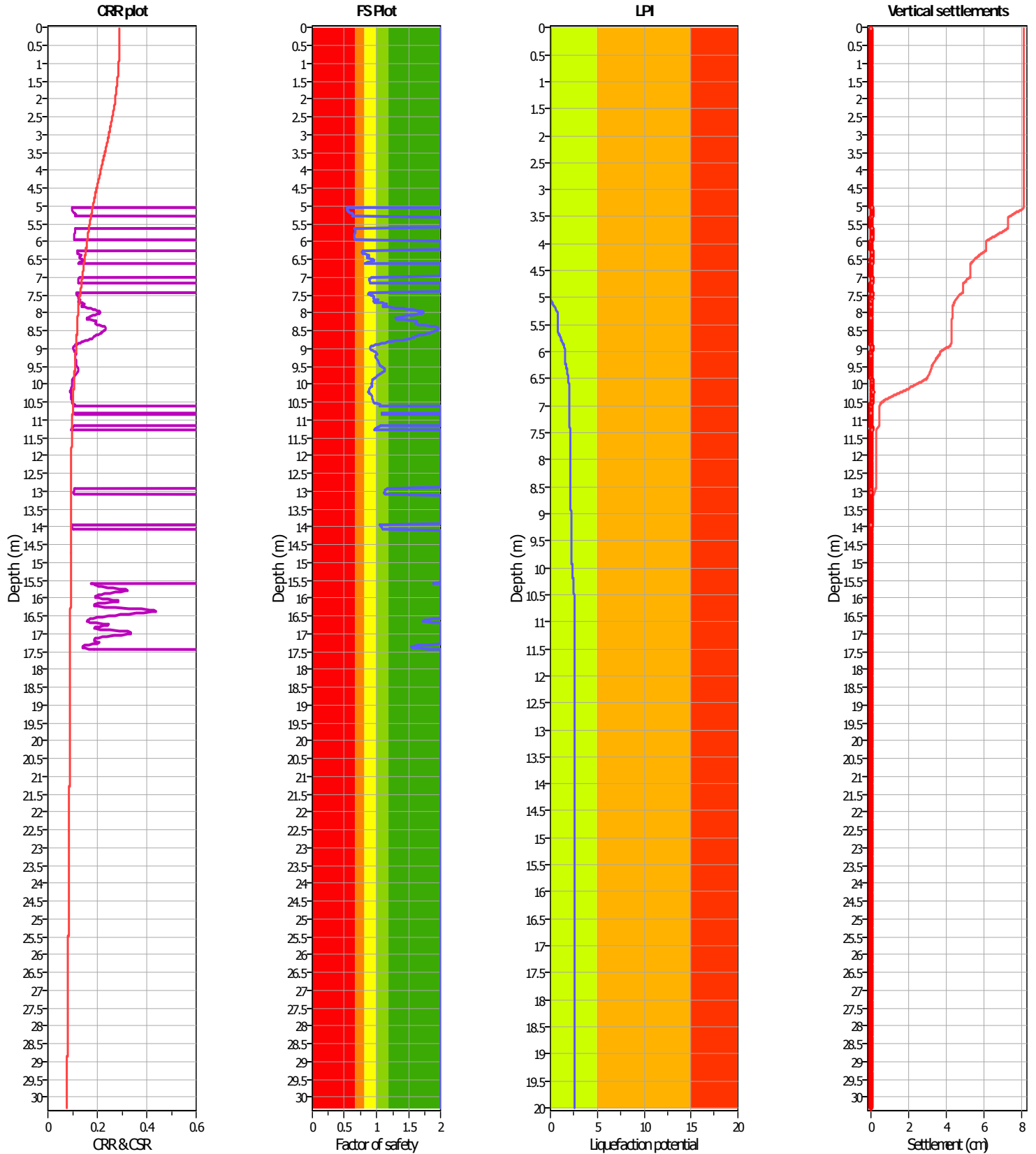
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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



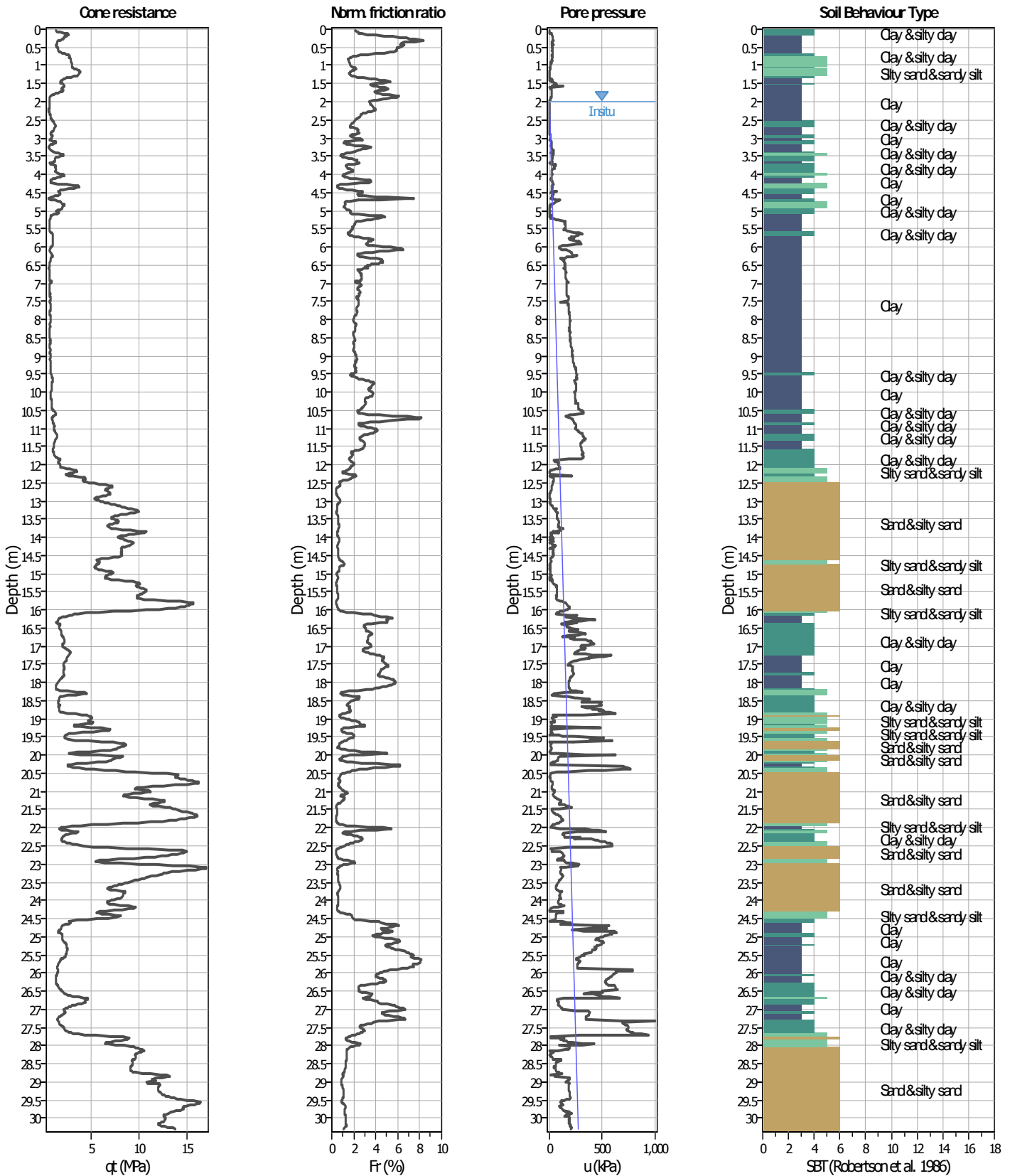
Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based

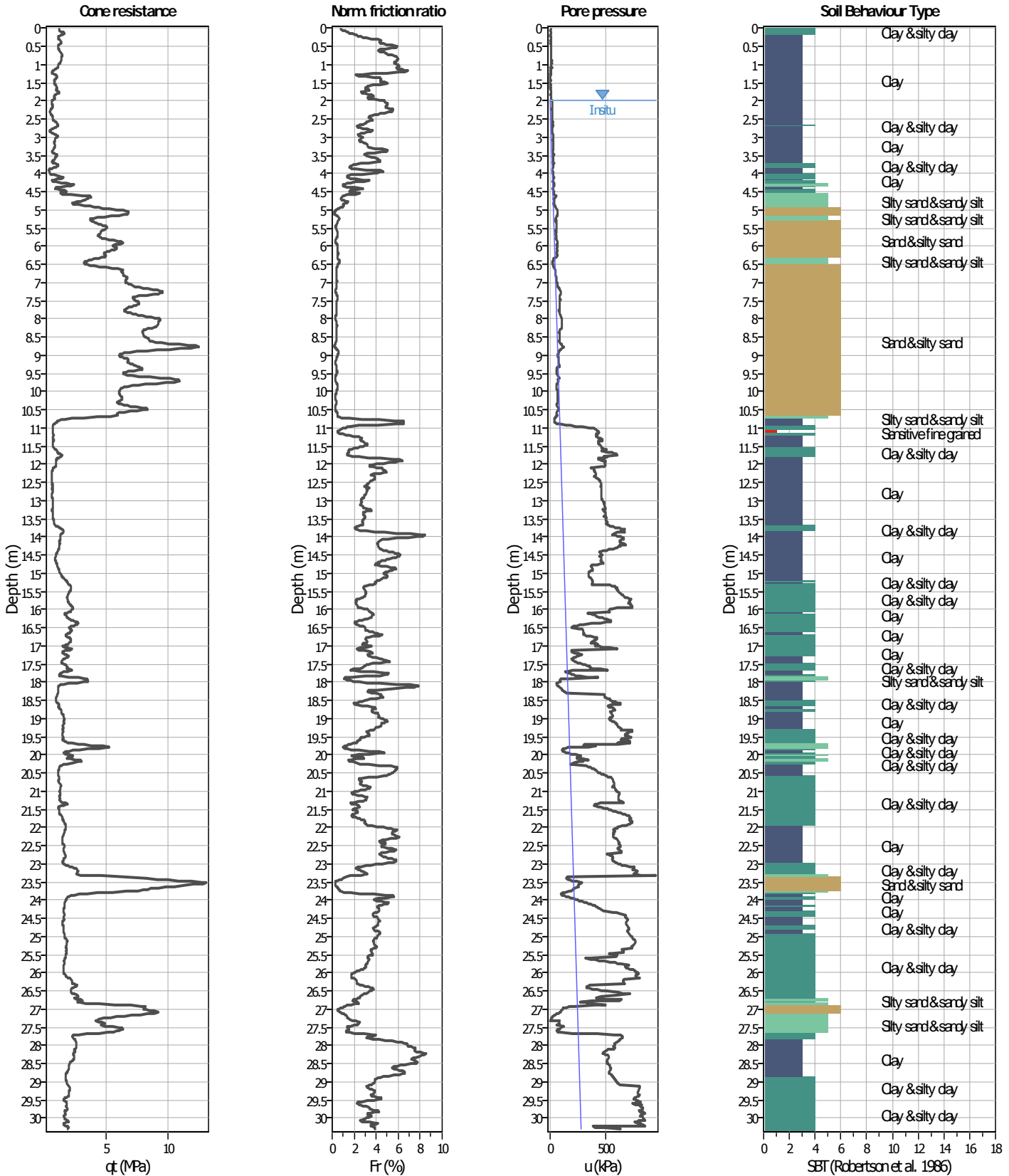


Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based

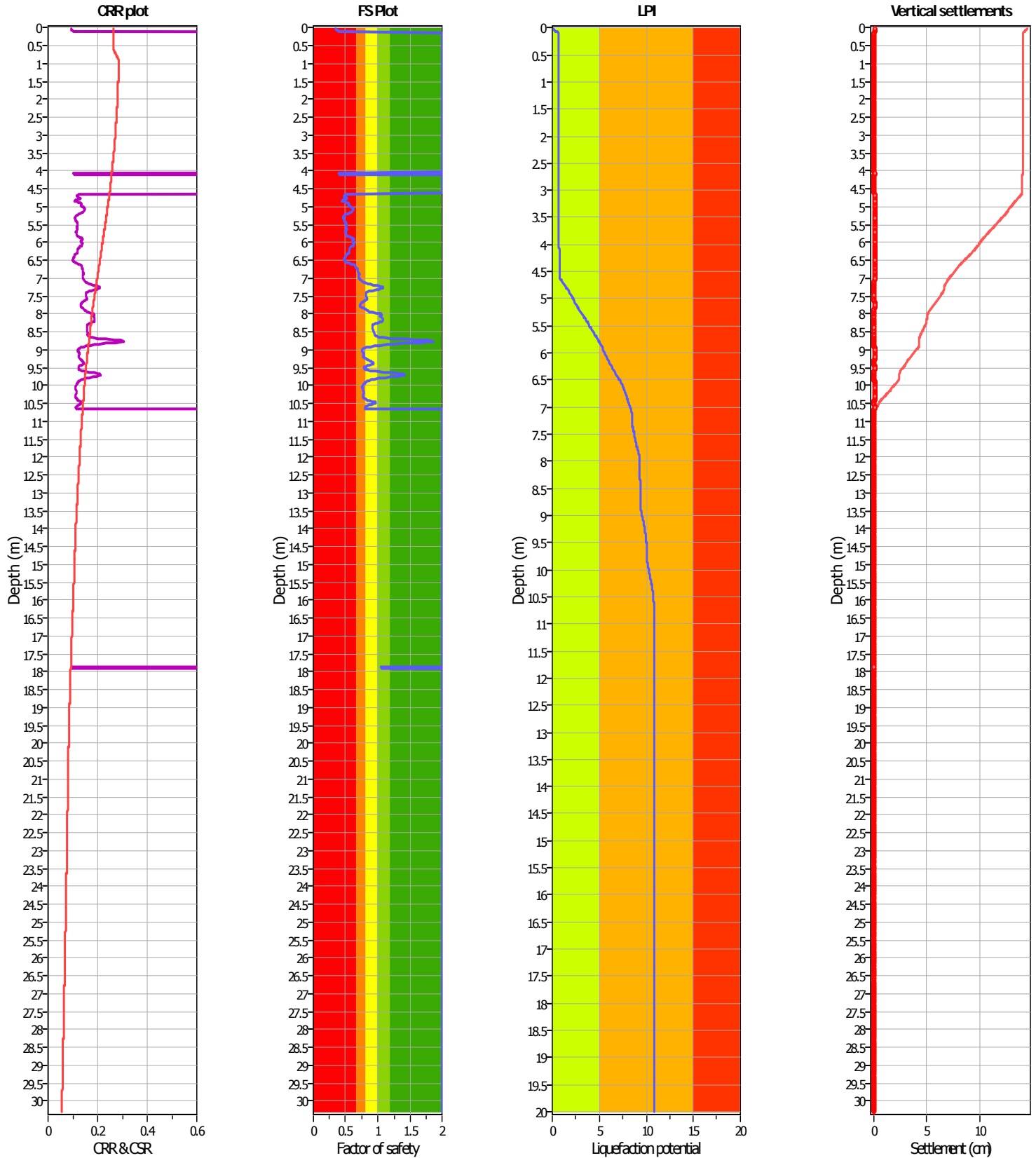




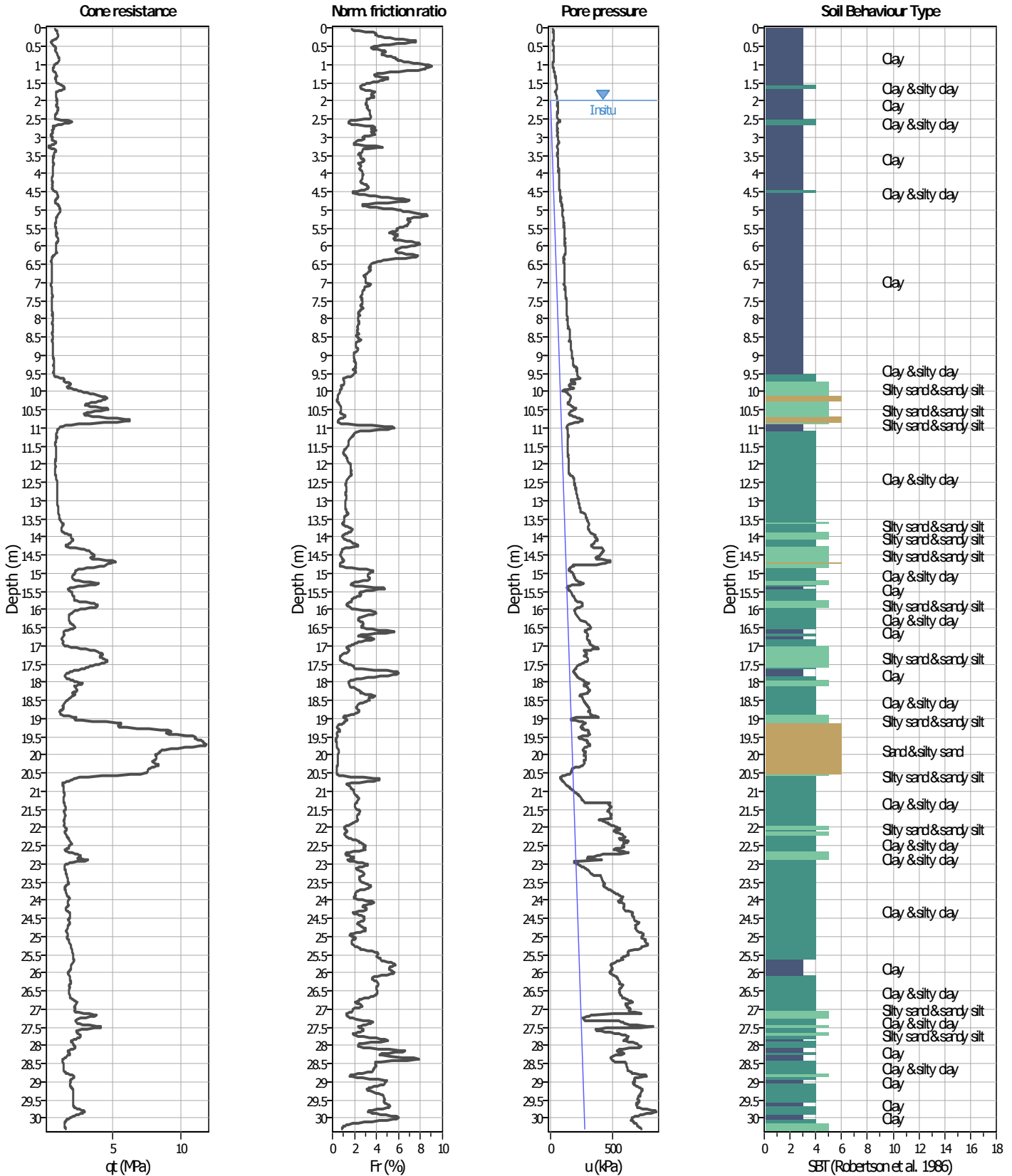
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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



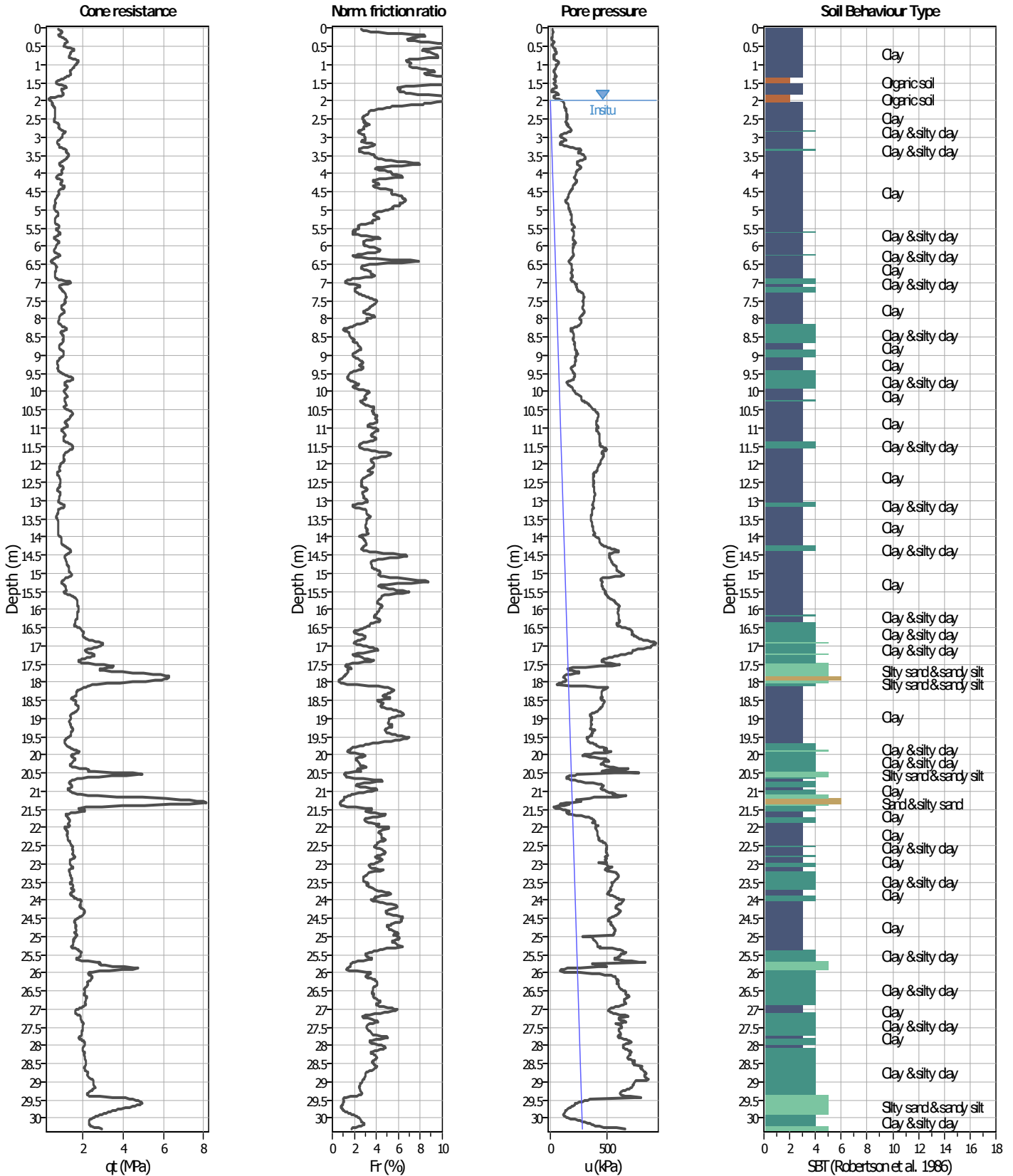
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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



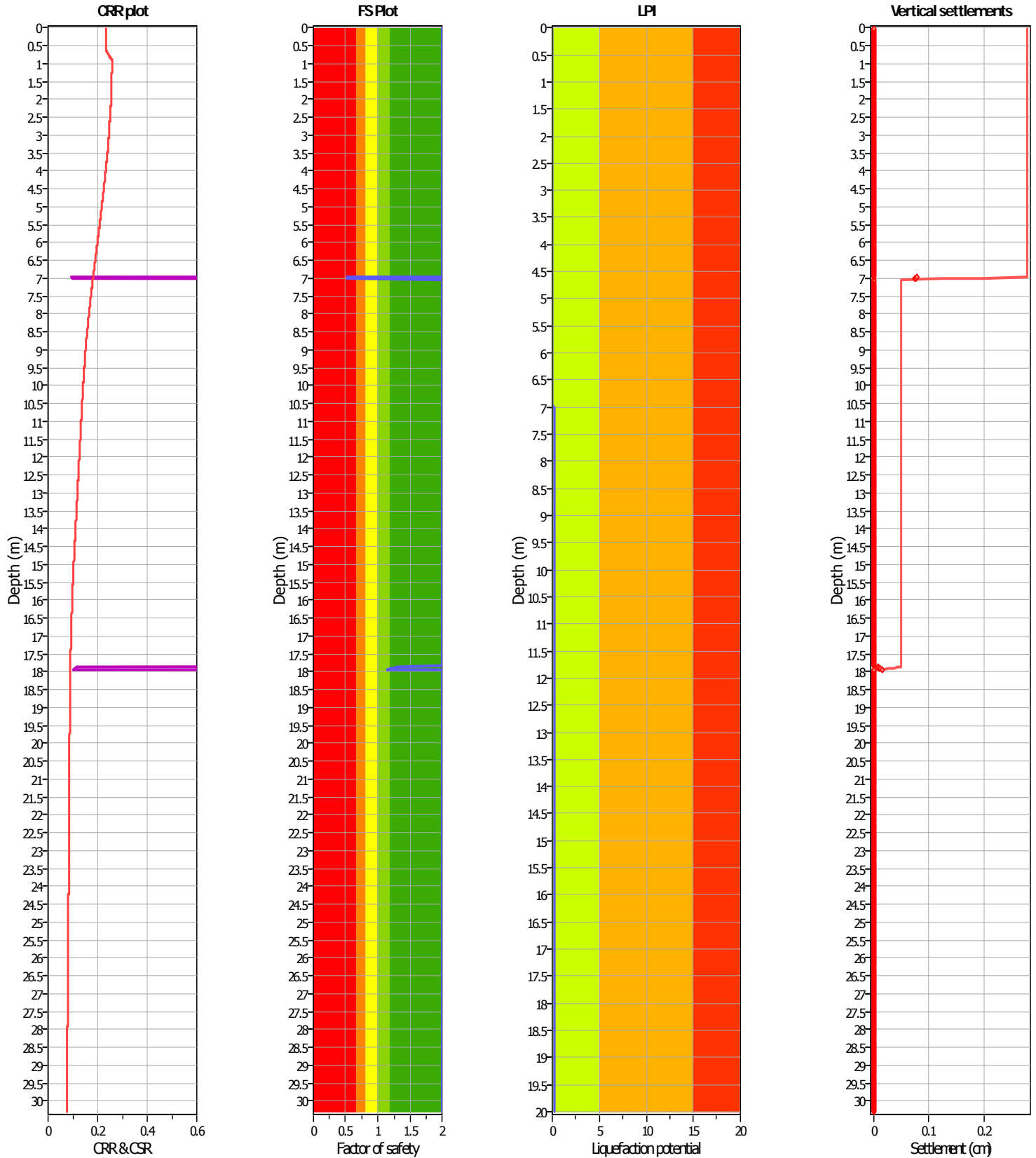
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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based

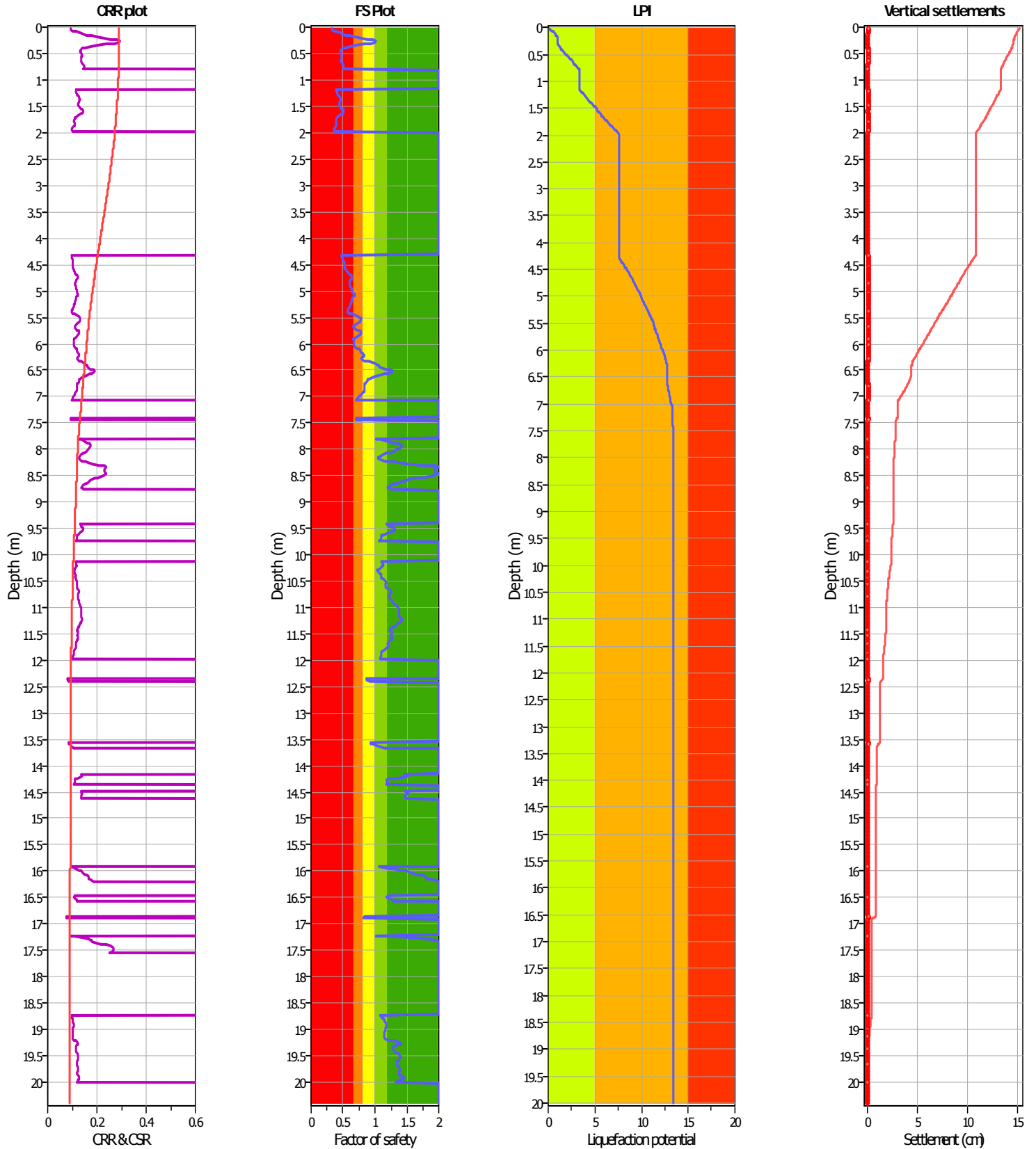


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Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.28	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based

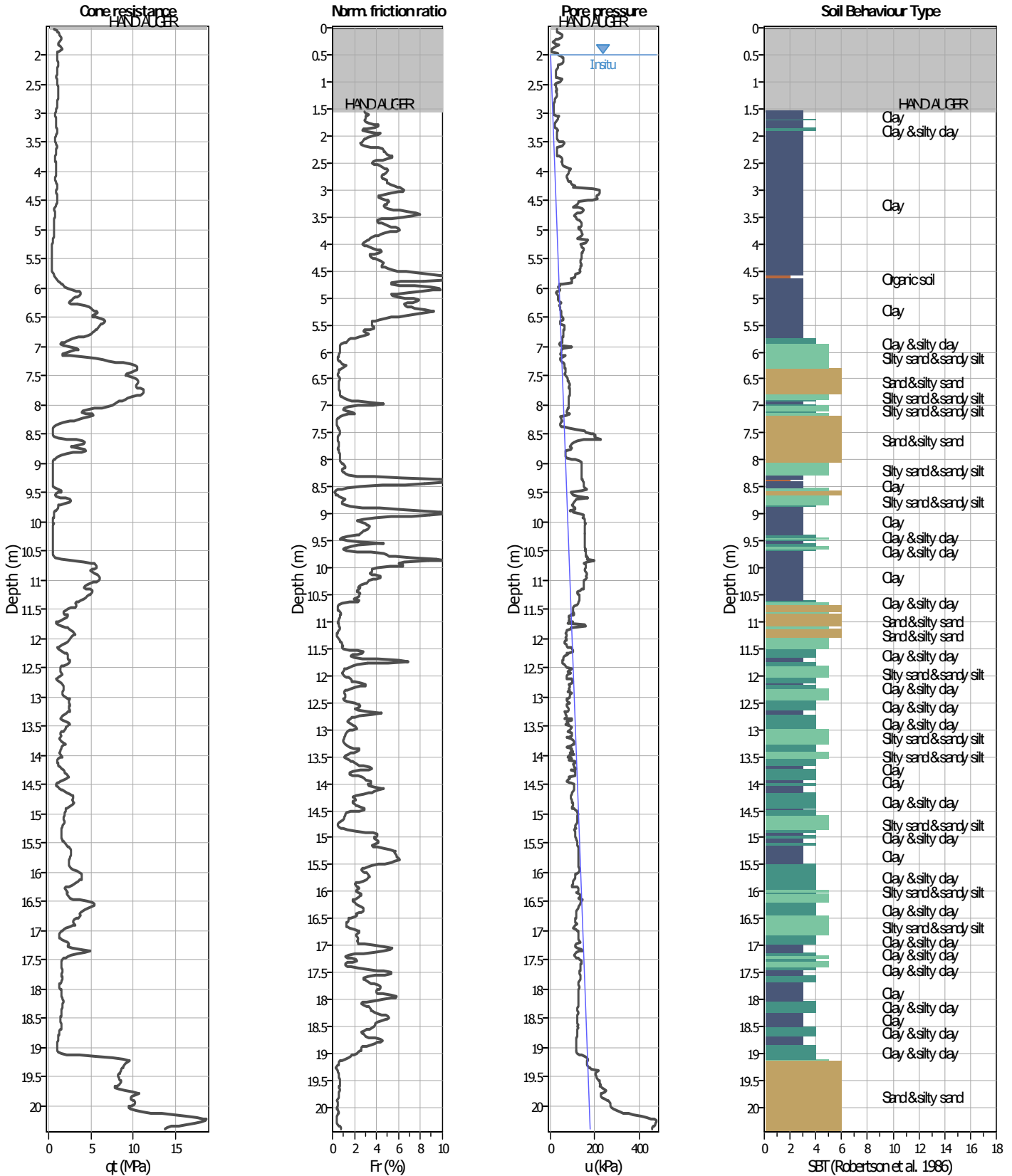




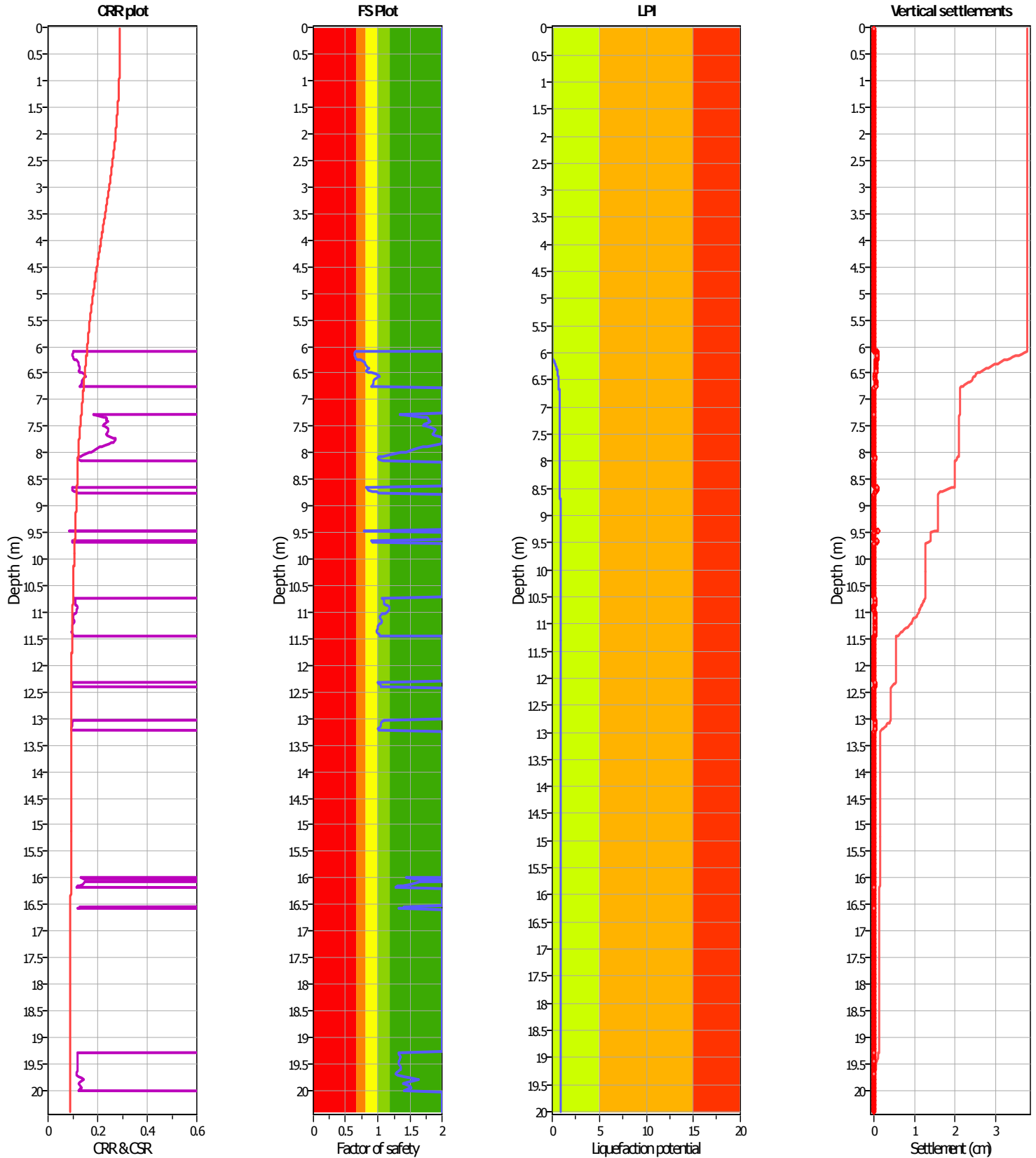




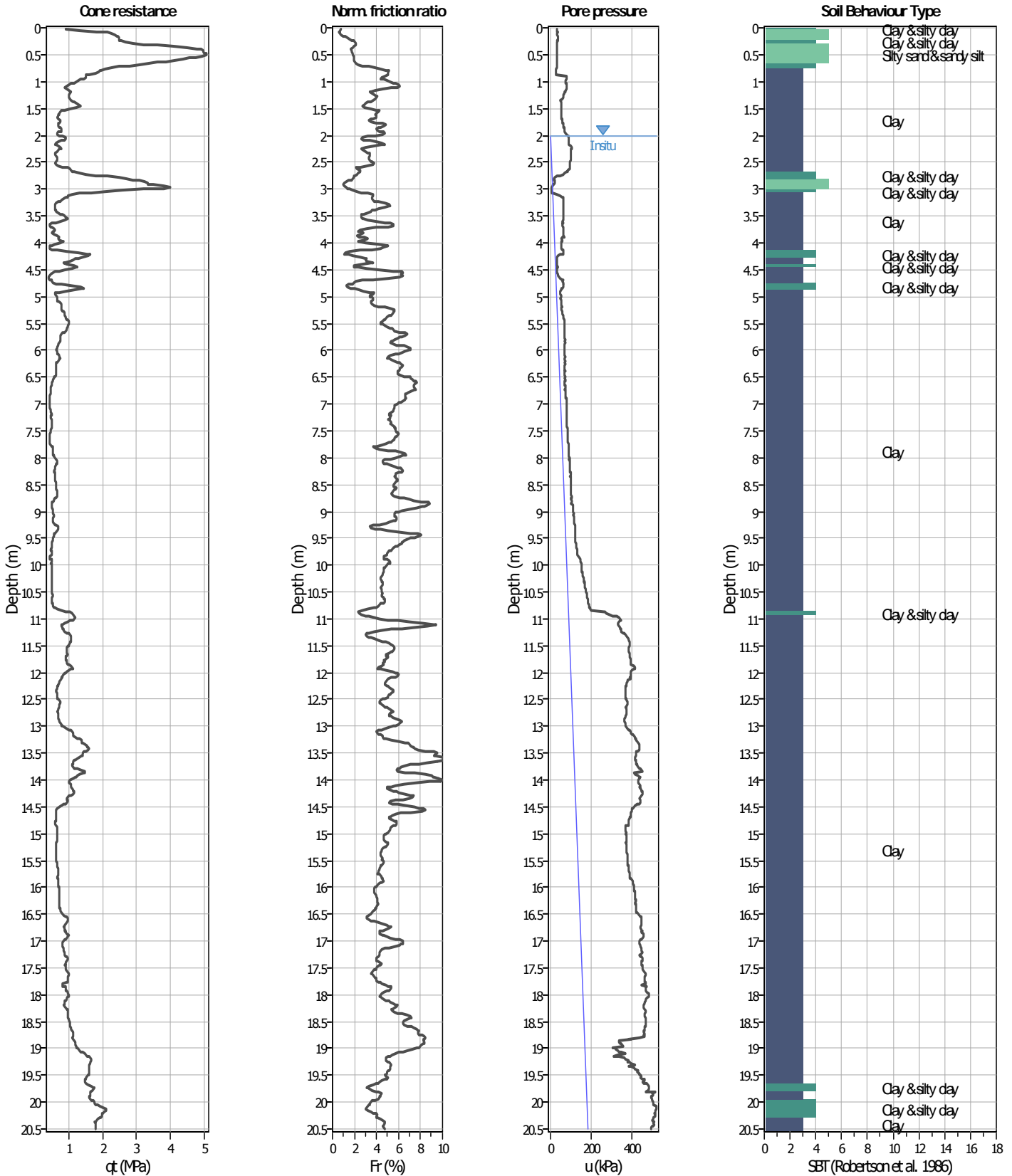
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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



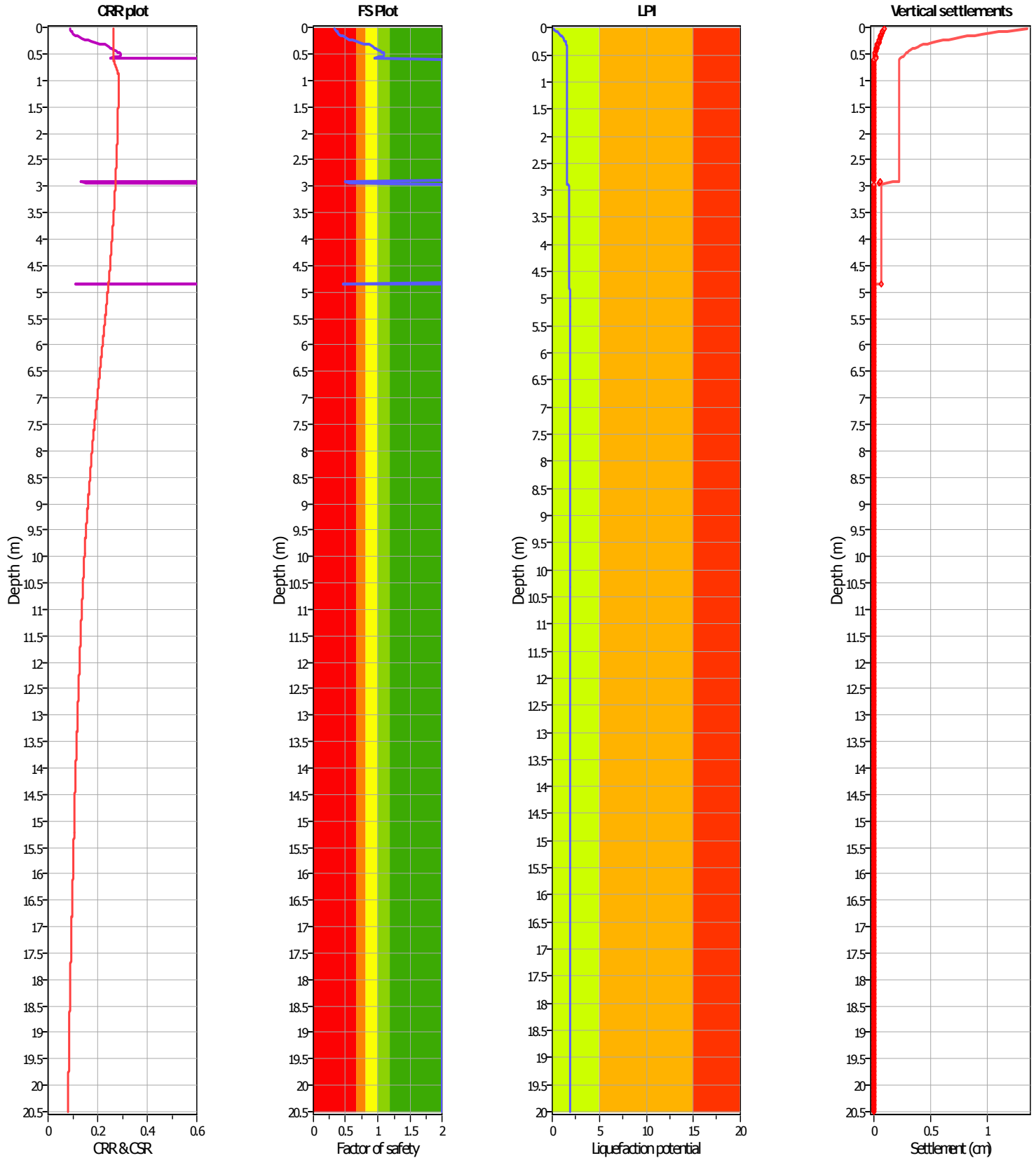
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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



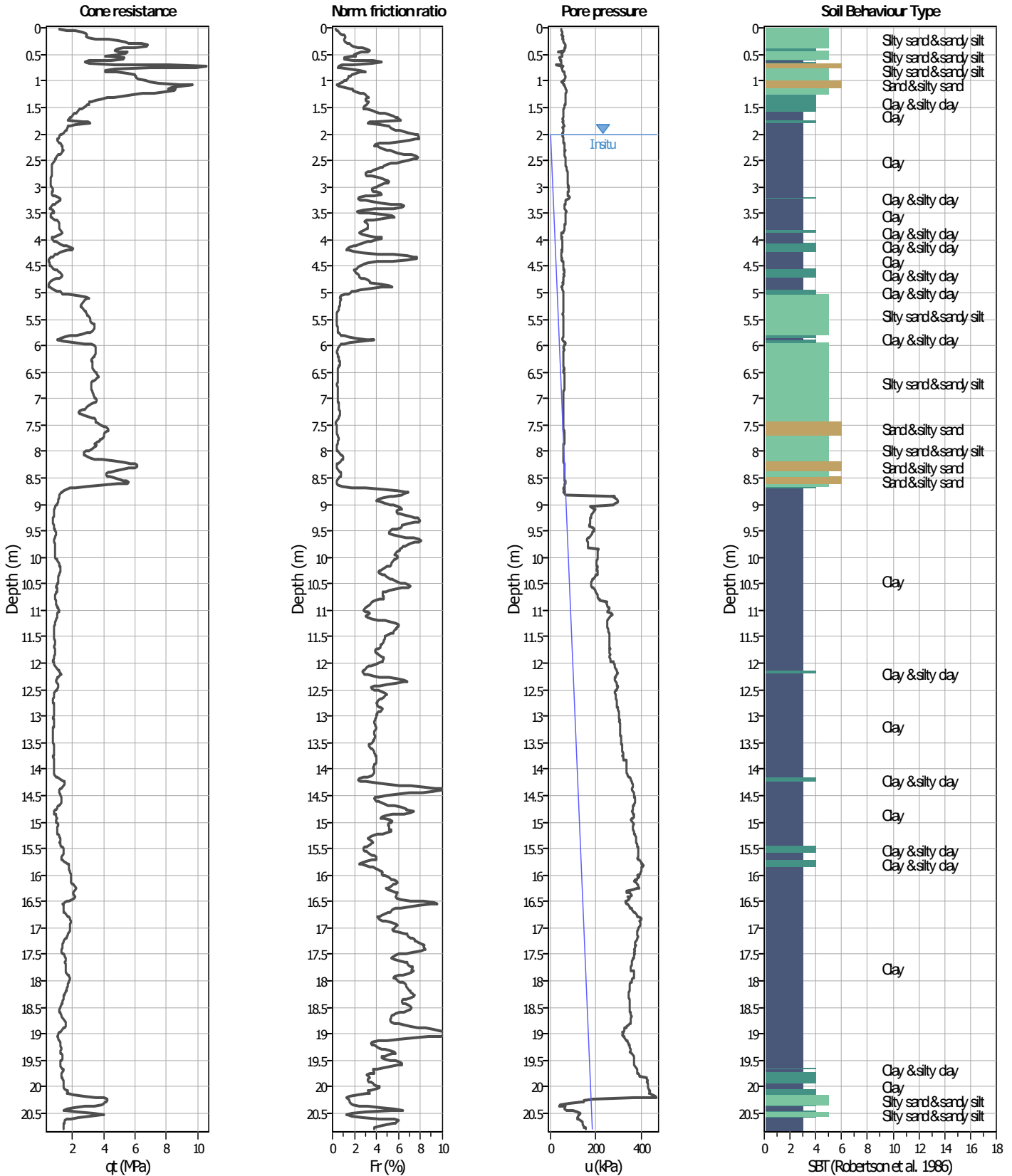
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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



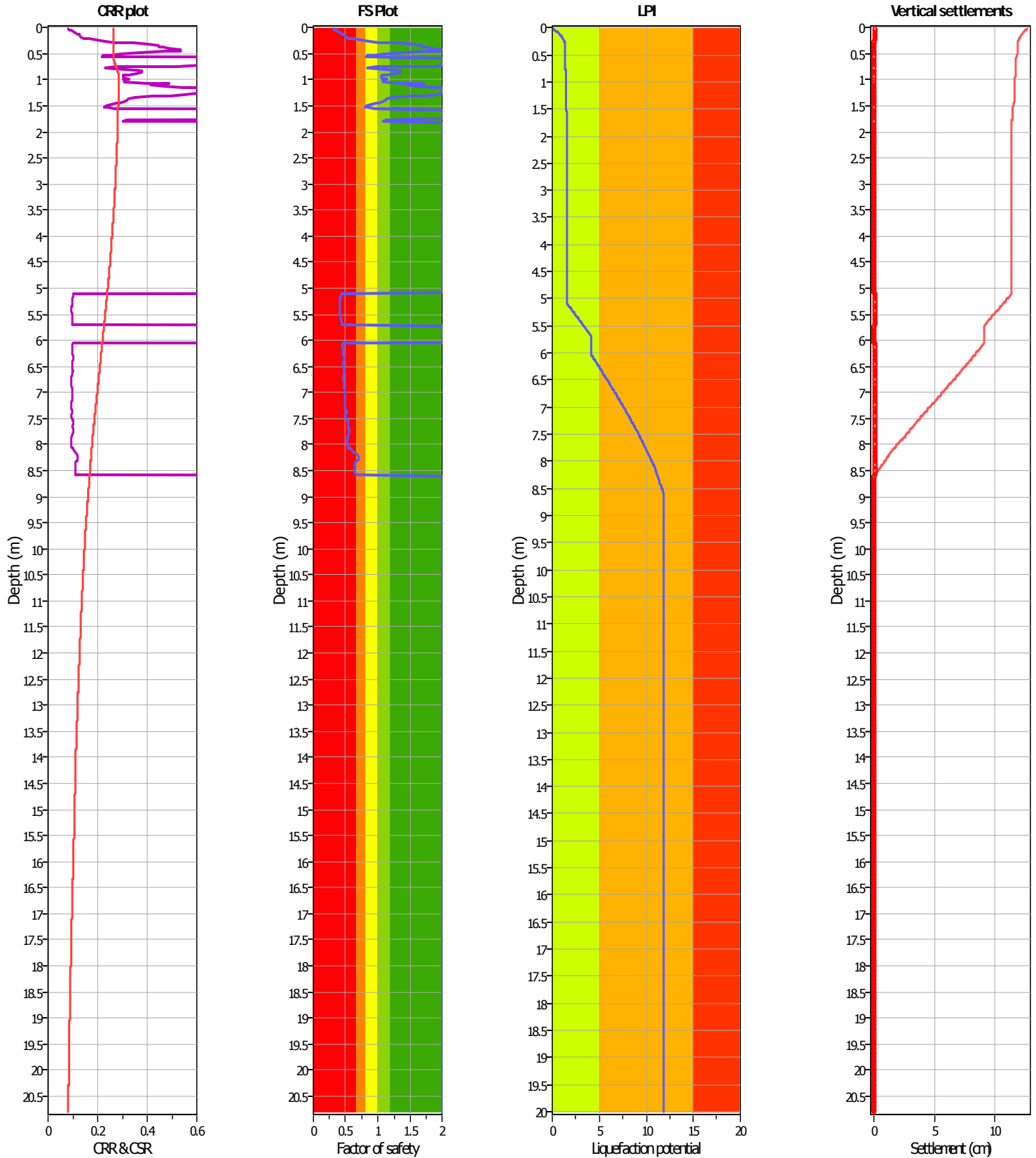
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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



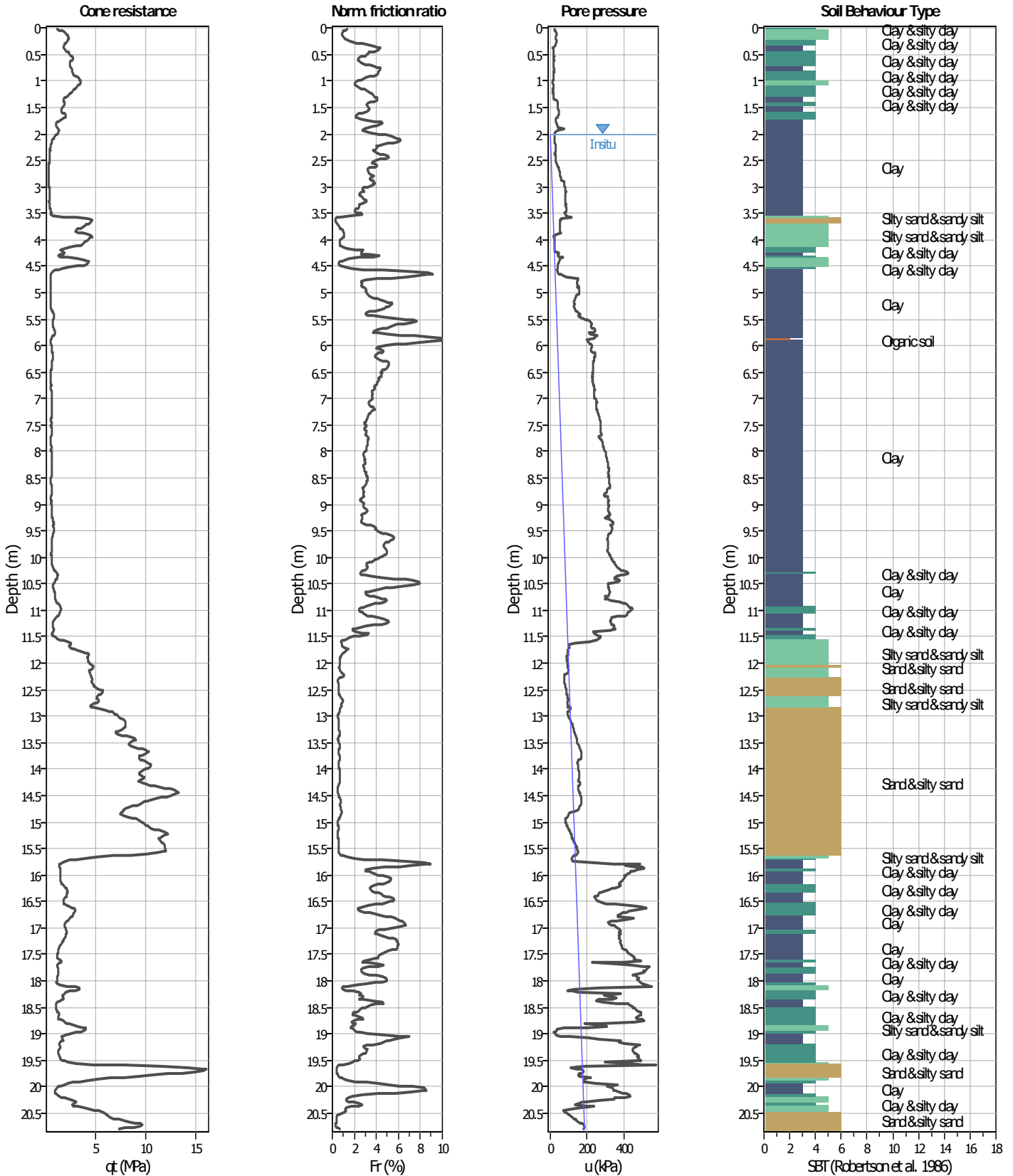
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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based

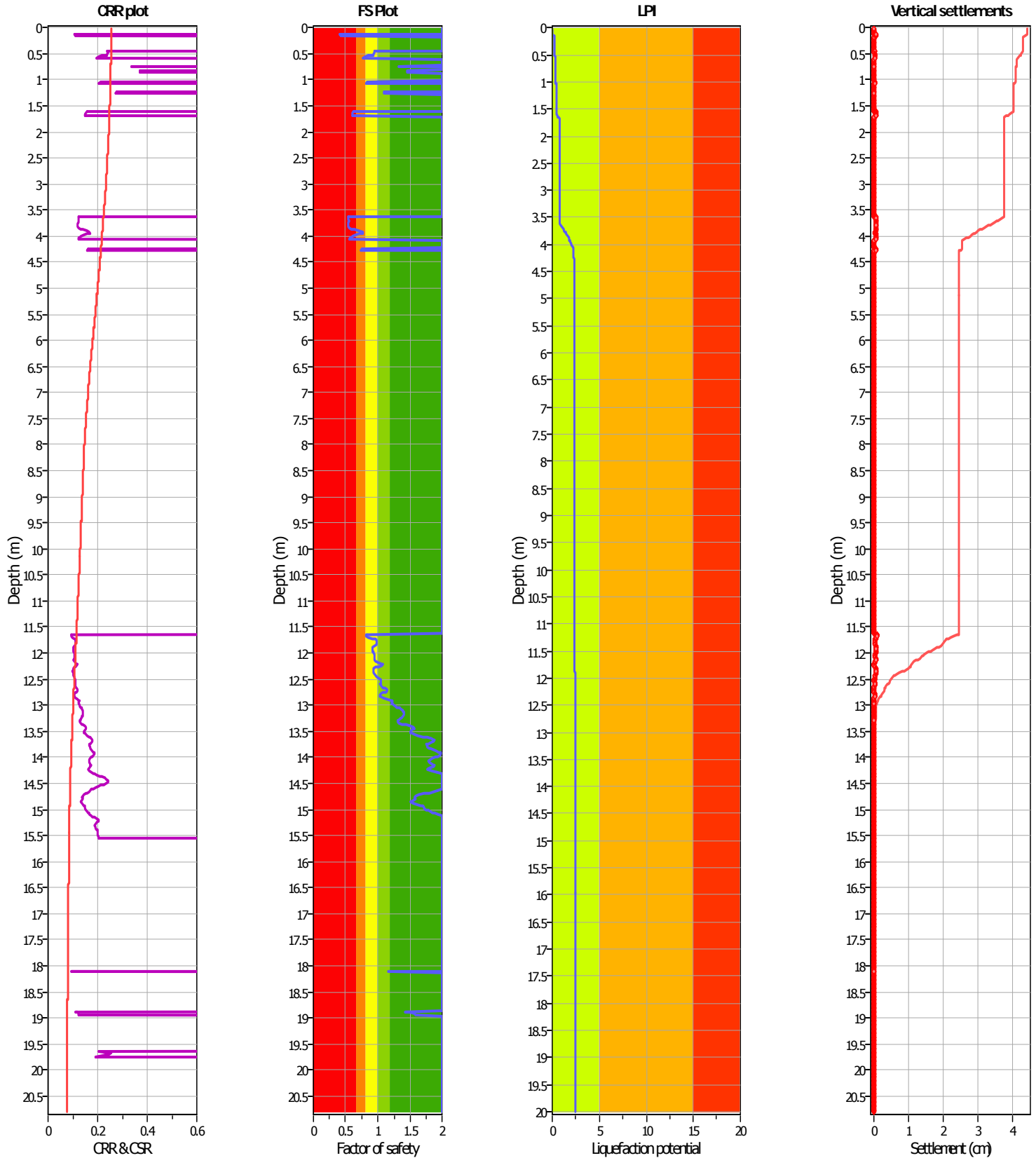


Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based

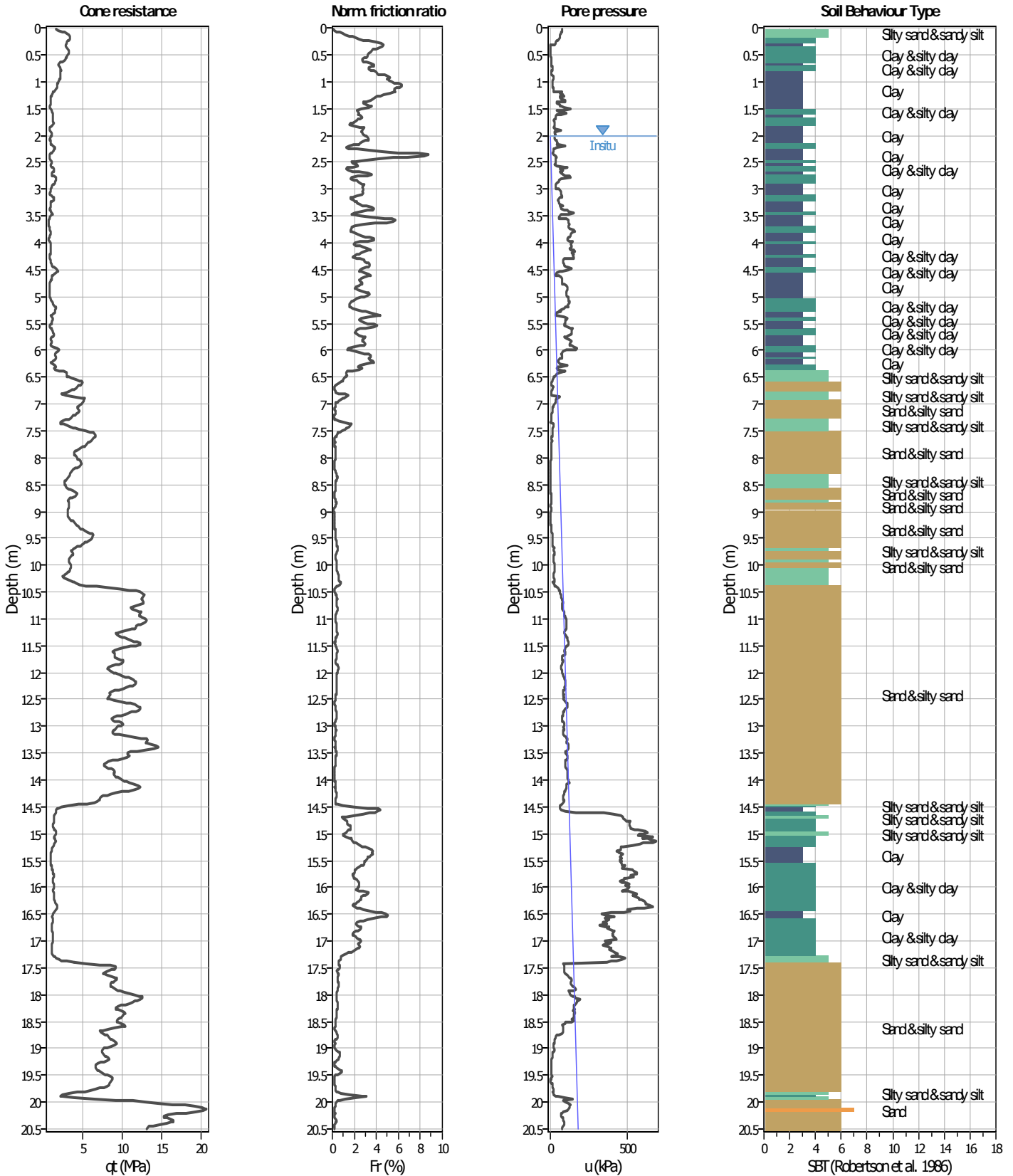


Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based

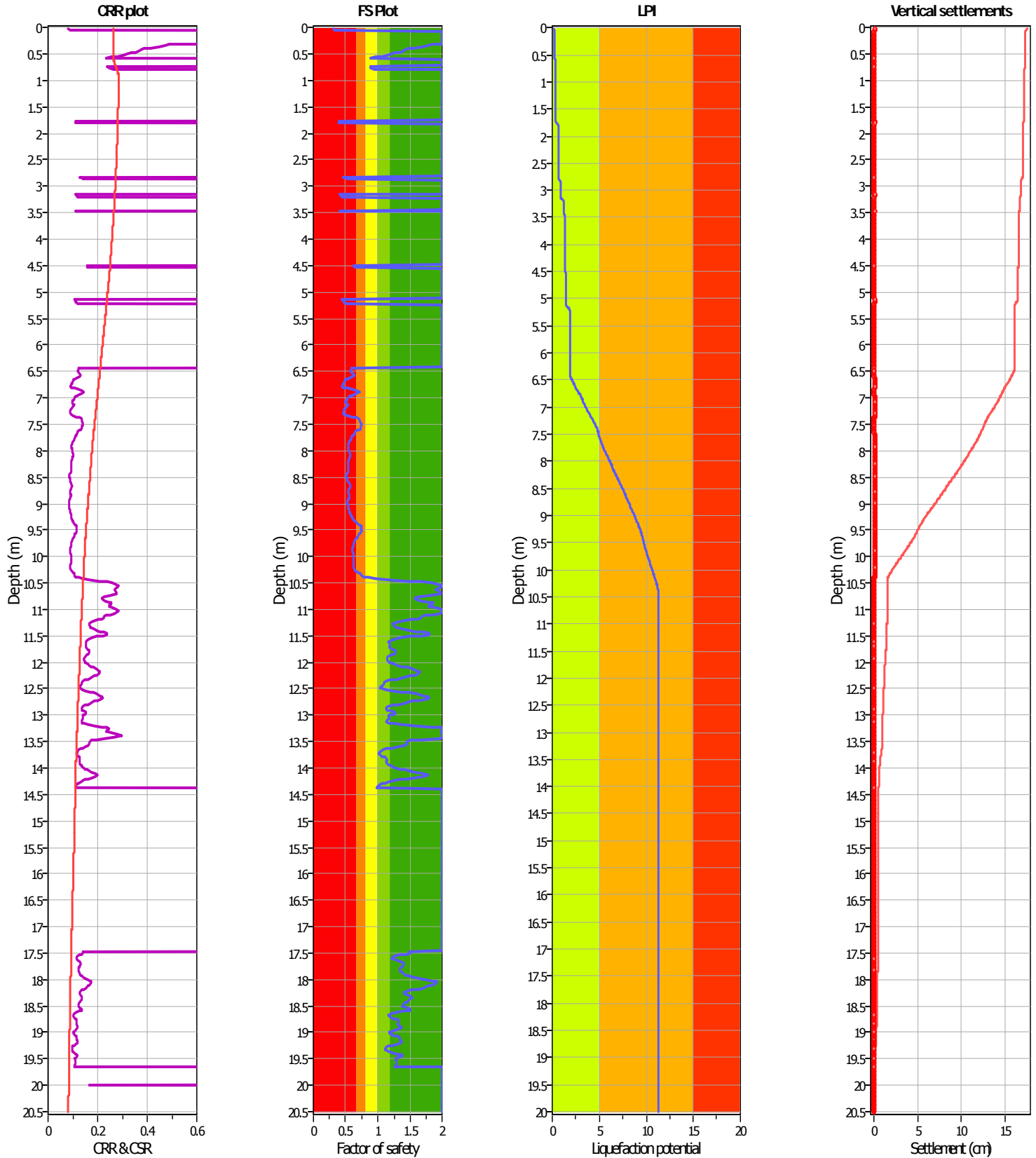




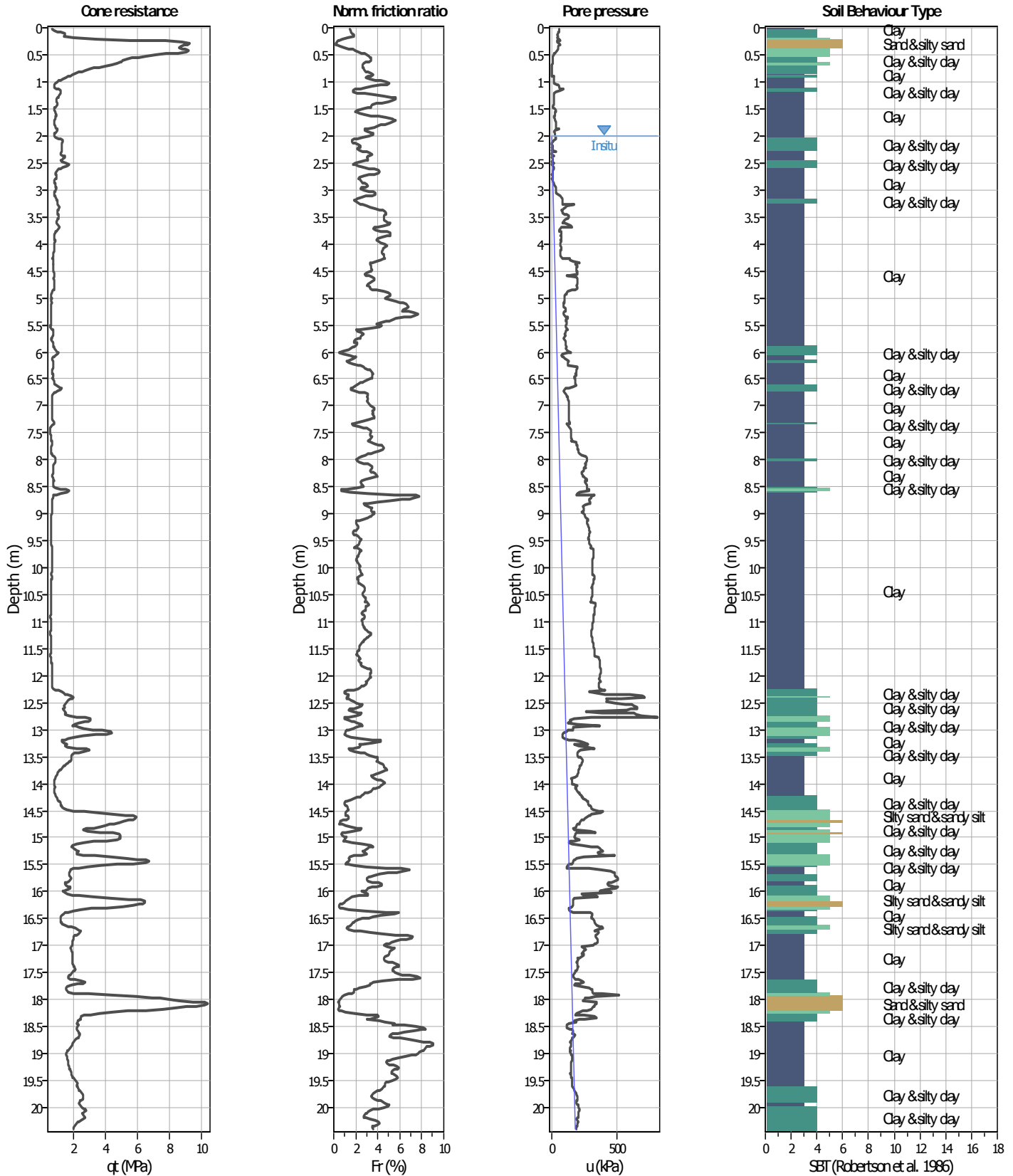
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Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



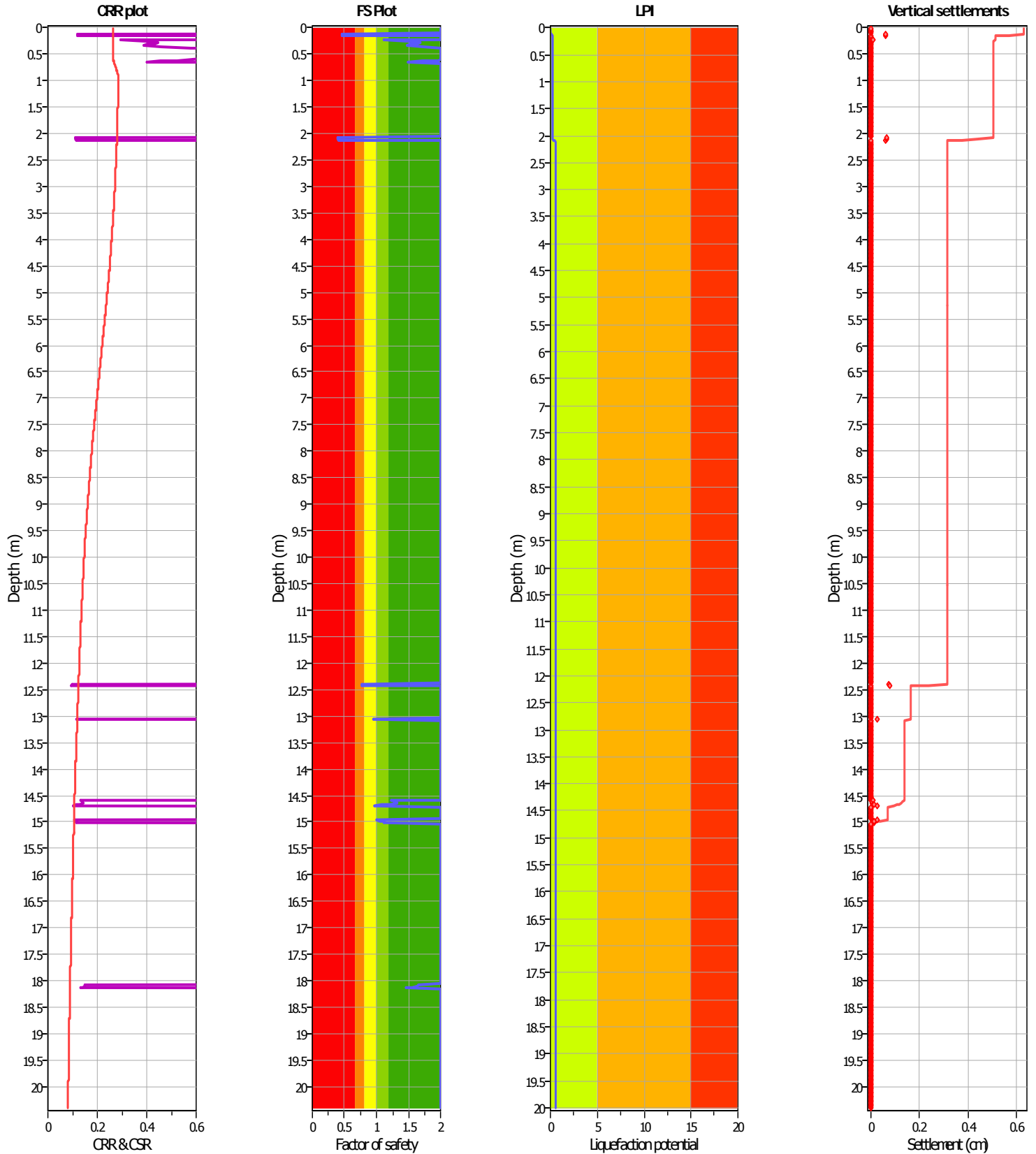
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Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



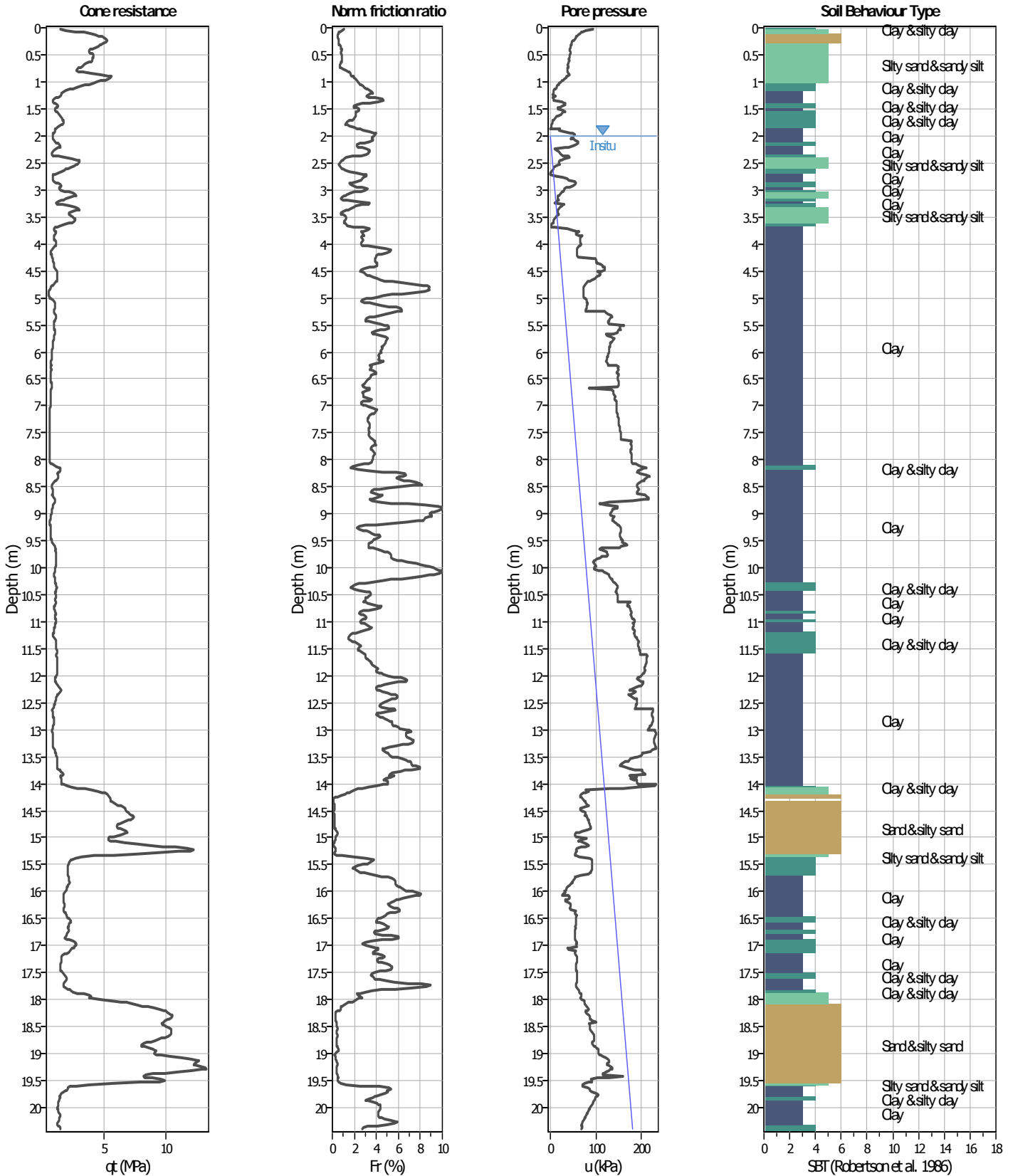
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Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



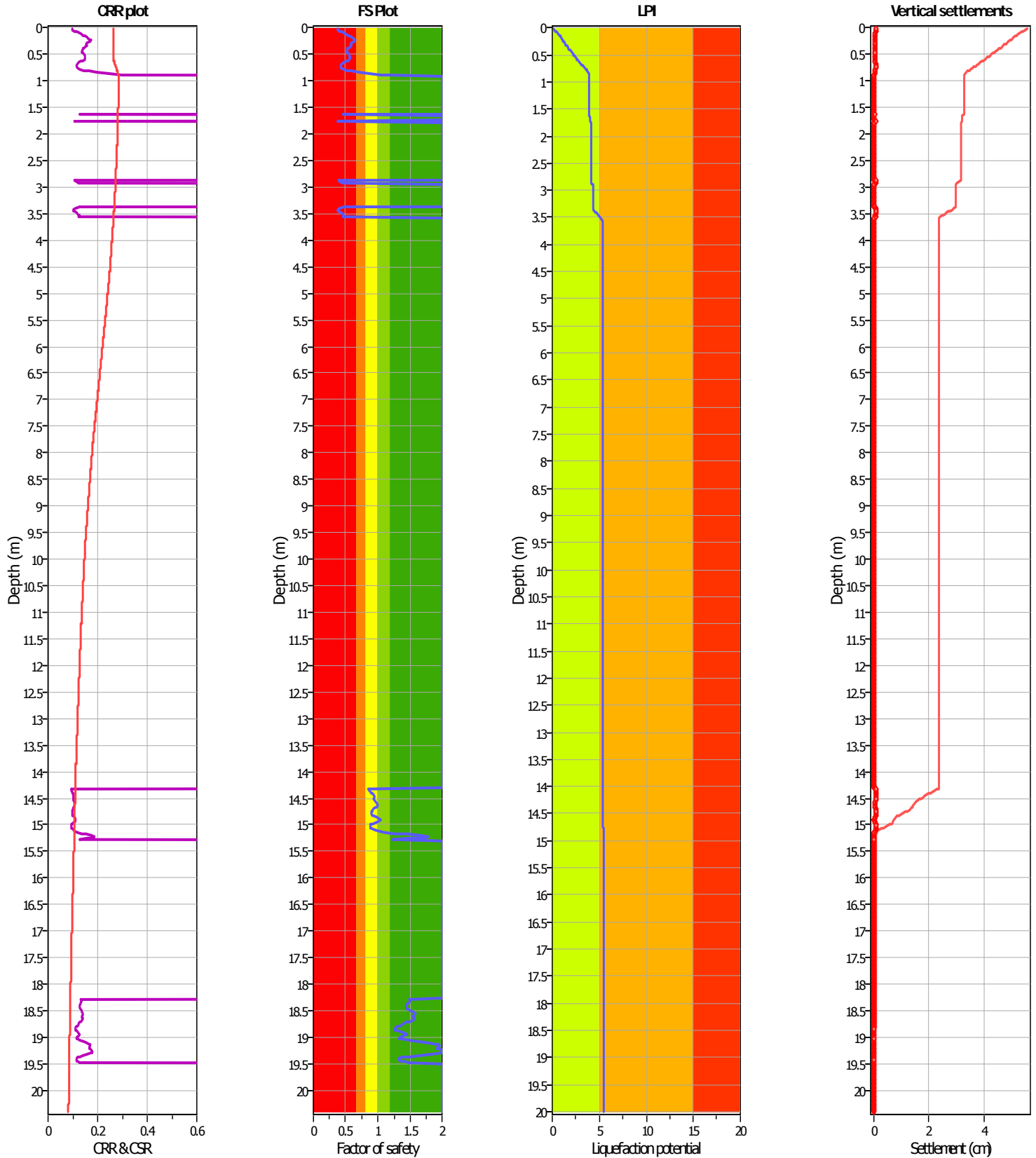
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Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



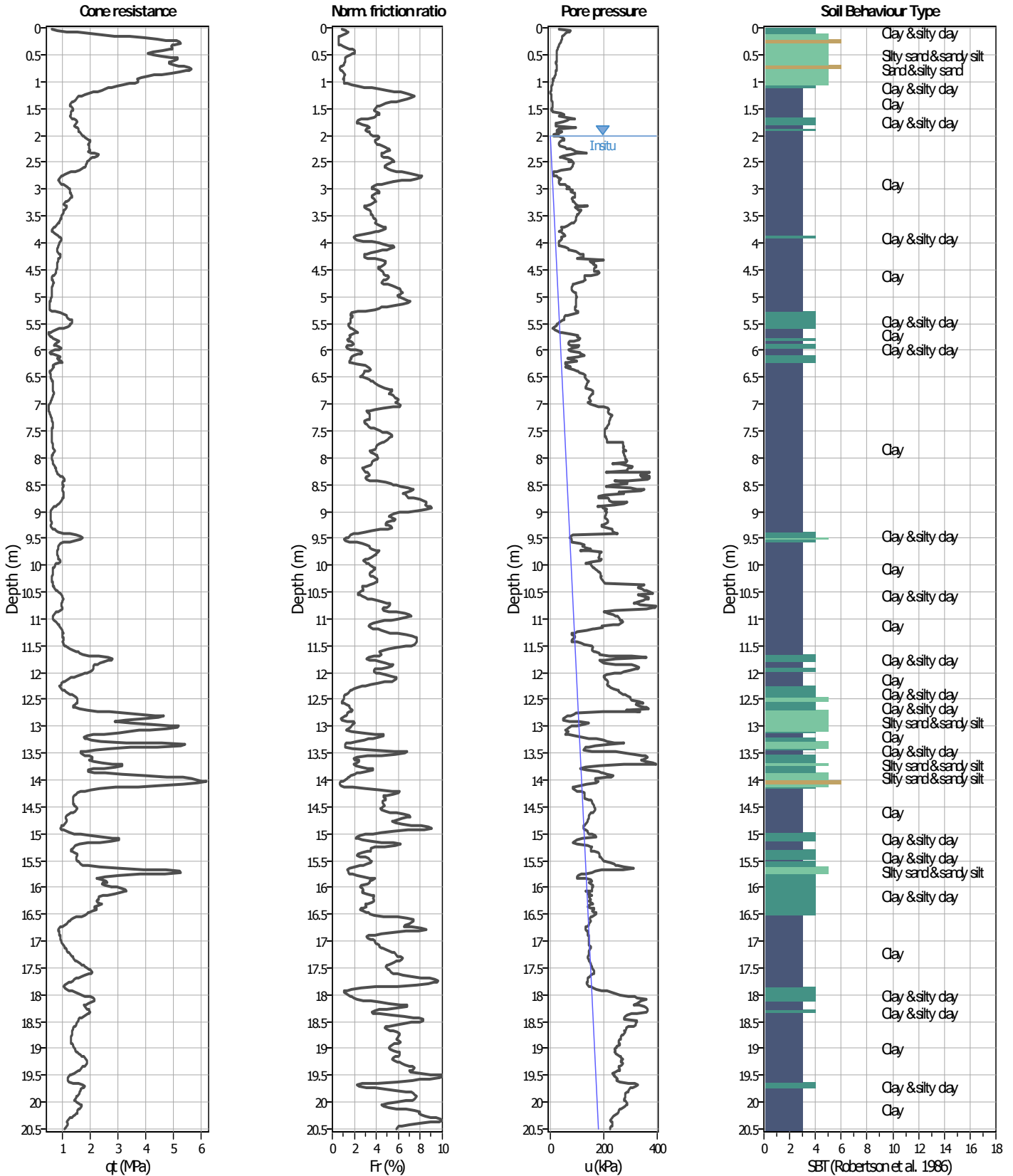
Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based

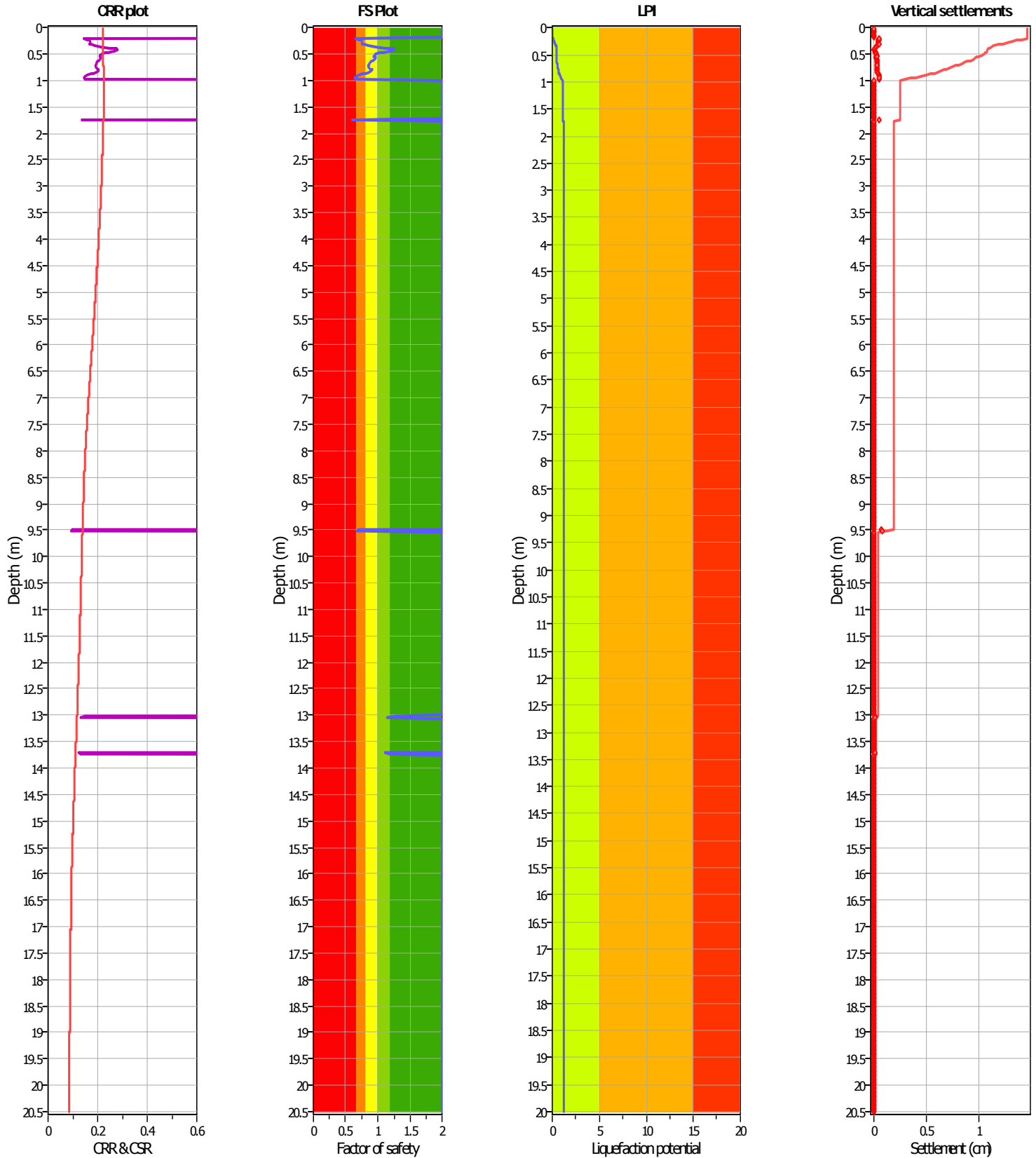


Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based

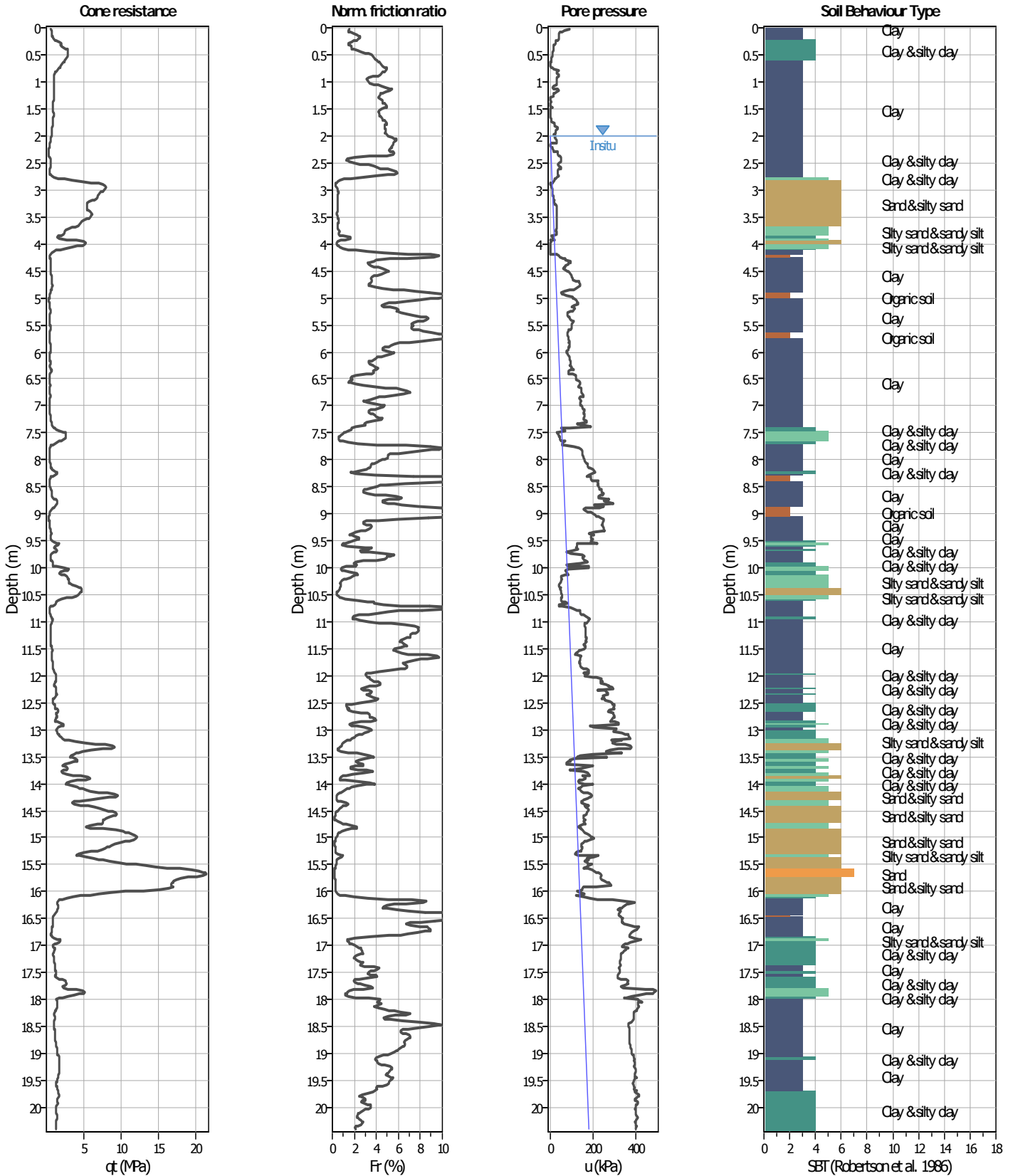


Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based

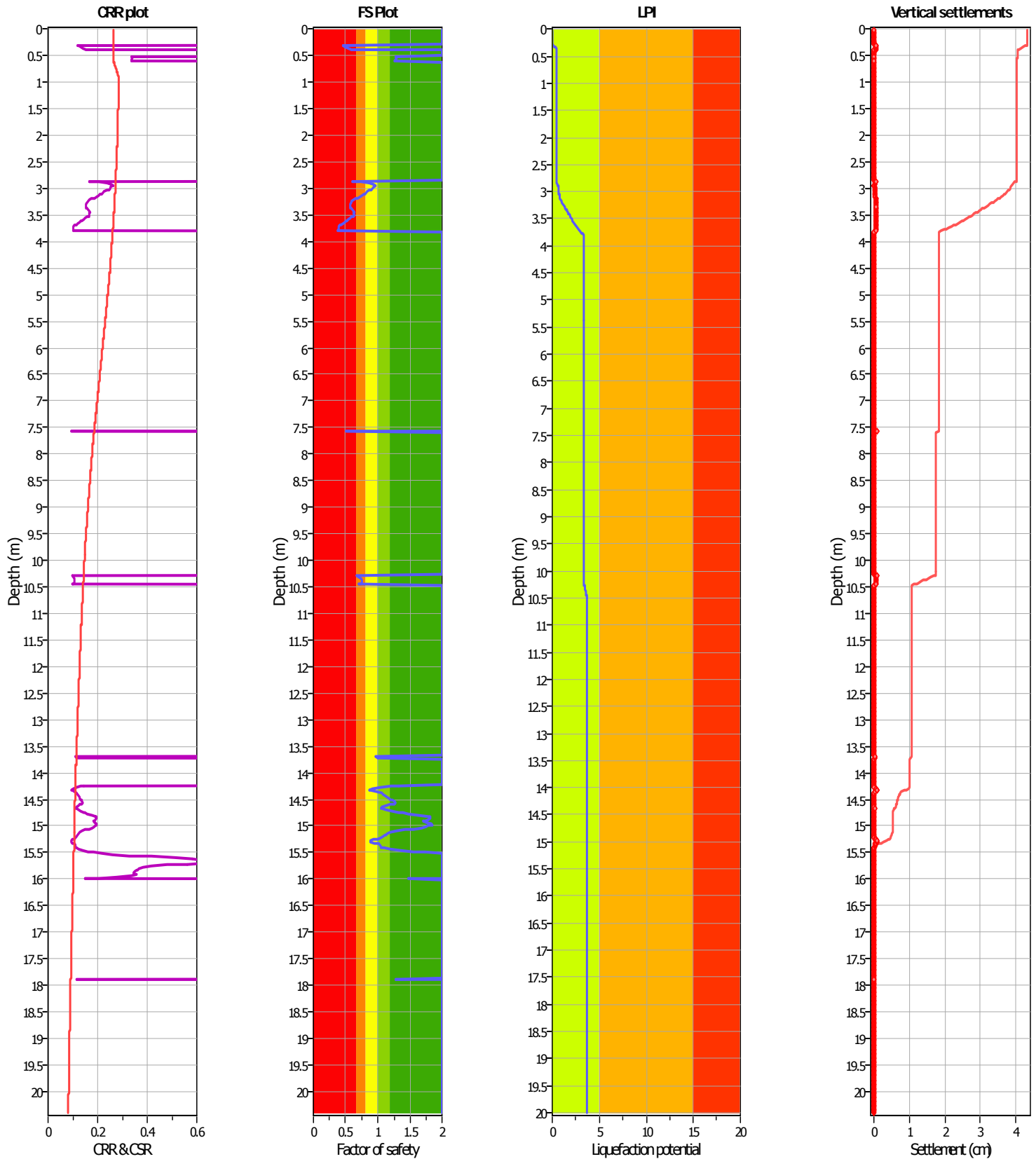




Analysis method:	NCEER (1998)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
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Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
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Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude $M_w$ :	6.14	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.22	Unit weight calculation:	Based on SBT	$K_0$ applied:	Yes	MSF method:	Method based