

Ivan Vela

T-Rex project meeting

November 24, 2021



AP1 – Redox kortlægning

- 1- Redox probe development
- 2- In-situ measurements
- 3- Comparison in-situ vs redox probe.
- 4-Future plans: where is redox going?

1. Redox probe development

- Continuously measuring redox is a very fragile method: only the platine can be exposed
- Push tests at Ejlskov: fat clay and sand = no problem
- Performing measurements at Fensholt below the plow layer = lots of problems

P017

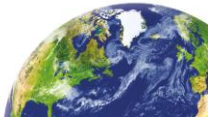
Start ref: 221

Slut ref: -100, drifter hele tiden

Ramte sten ved 4.4 m. Ville ikke gentage punktet da var kommet dybt nok

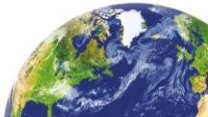
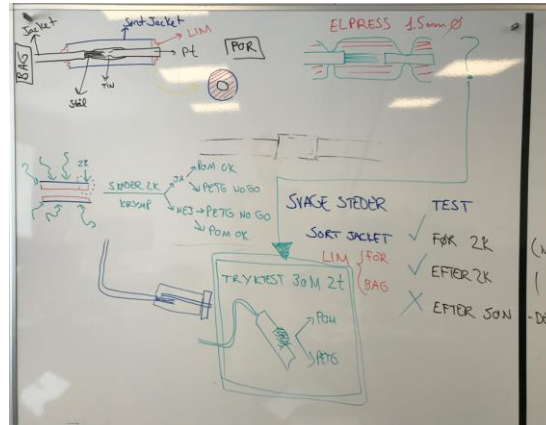
Da sonden ikke var i spec ved slut ref test, var den defekt, og skal checkes i basen. Pakker sammen og kører til basen

Michael Clausen's fieldnotes. Fensholt October 2020



1. Redox probe development

- Finding new ways of mounting the Pt electrode in the probe
- Making the connections stronger
- Hammering the probe against a steel plate = OK
- Fensholt below plow layer = boulders still braking the electrode!

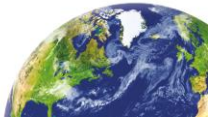
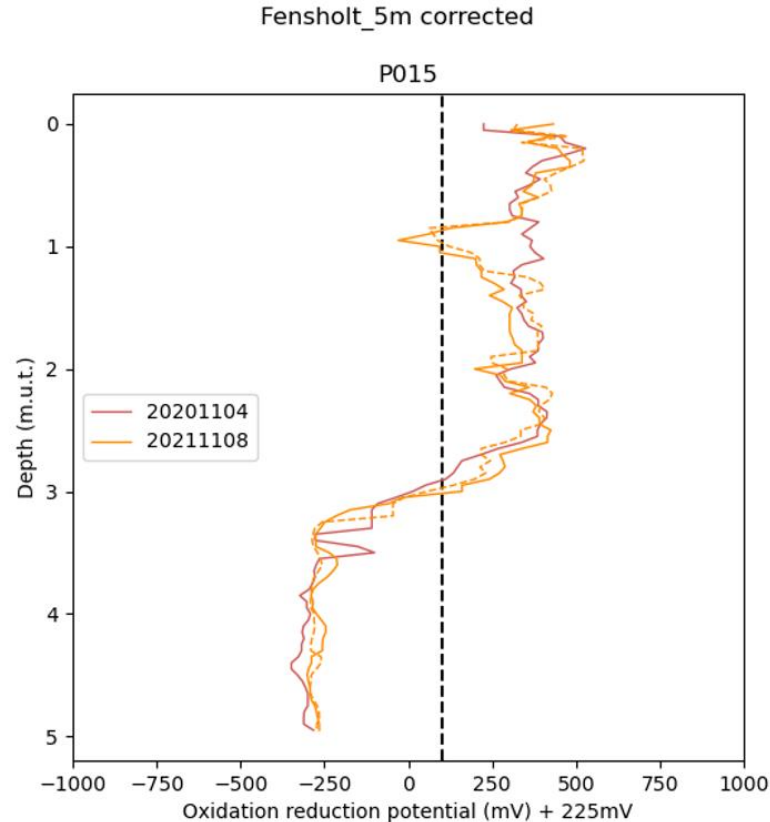


1. Redox probe development

-Finally came at a robust Pt electrode

-But how to know if the electrode brakes down the hole?

-**Dual redox:** two Pt in one probe and new electronics



2. In-situ measurements

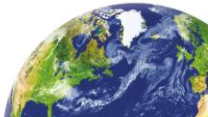
- Why? We wanted data validation for the redox probe
- Where? At five points in Fensholt close to piezometers and previous redox measurements
- When? 7 times from Oct'20 to Feb'21



2. In-situ measurements

-How?

- 4 depths: 50, 100, 150 & 200 cm
- 2 duplicates each depth
- 3 distances each duplicate
- 3 last measurements
- 3 different instruments

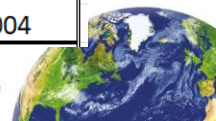


3- Comparison in-situ vs redox probe

-3 redox probe measurements close to 3 of the dates

All Redox values are raw - uncorrected

	In-situ	In-situ Ave.	Redox Probe	In-situ	In-situ Ave.	Redox Probe	In-situ	In-situ Ave.	Redox Probe	
In-situ nr.	11-11-2020		04-11-2020	08-12-2020		01-12-2020	21-12-2020		22-12-2020	Probe Pktnr.
11-50-1	-256			-132			-124			P001
11-50-2	-216	-236	115	-225	-178,5	348	-246	-185	295	
11-100-1	50			88			66			
11-100-2	143	96,5	100	168	128	243	85	75,5	103	
11-150-1	108			191			170			
11-150-2	443	275,5	94,3	456	323,5	199	428	299	133	
11-200-1	-			-			408			
11-200-2	-			-			334	371		
21-50-1	-254			-224			-319			P004
21-50-2	110	-72	28.6	131	-46,5	151	-327	-323	320	
21-100-1	-302			123			109			
21-100-2	-295	-298,5	-251	212	167,5	6.5	160	134,5	80.9	
21-150-1	112			-129			-108			
21-150-2	-242	-65	-241	-412	-270,5	3.1	-403	-255,5	-45	
21-200-1	-			-			-387			
21-200-2	-			-			149	-119	-51	



3. Comparison in-situ vs redox probe

-3 redox probe measurements close to 3 of the dates

31-50-1	447			524			518				
31-50-2	424	435,5	254	491	507,5	358	485	501,5	120		
31-100-1	422			491			471				
31-100-2	426	424	163	481	486	223,2	472	471,5	185		
31-150-1	447			469			446				
31-150-2	413	430	125	466	467,5	141,6	457	451,5	94,6		
31-200-1	409			396			358				
31-200-2	414	411,5	204	439	417,5	50,6	430	394	133,6	P007	
41-50-1	-256			-217			-105				
41-50-2	-26	-141	104	149	-34		30	-37,5			
41-100-1	433			472			463				
41-100-2	20	226,5	127	337	404,5		360	411,5			
41-150-1	406			436			440				
41-150-2	394	400	170,4	310	373		387	413,5			
41-200-1	387			411			407				
41-200-2	246	316,5	-86	437	424		444	425,5		P011	
61-50-1	-274			-261			-254				
61-50-2	433	79,5	37,1	467	103	287	407	76,5	144,9		
61-100-1	440			141			111				
61-100-2	383	411,5	-30,2	426	283,5	300	385	248	177		
61-150-1	459			211			218				
61-150-2	460	459,5	69,7	390	300,5	276	444	331	152,4		
61-200-1	-			-			492				
61-200-2	-			-			413	452,5	138,05	P014	



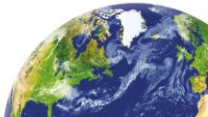
3. Comparison in-situ vs redox probe

-We have left the redox probe some time underground to see how the value evolves

Jord temp : 2°C

De målinger der er markeret med **fed/bold** er hvor begge elektroder var tilkoblet pelicasen

Måleinstrument	Reference <u>electrode</u> hul #	Ledning	Start (0 sek)	Slut (60s)
Python	1	Gul/PT1	206	198
Python	1	Sort/PT2	4	13
<u>Pelicasen</u>	1	Gul/PT1	163	159
<u>Pelicasen</u>	1	Sort/PT2	-23	-14
<u>Pelicasen</u>	1	Gul/PT1	139	139
<u>Pelicasen</u>	1	Sort/PT2	-13	-14
15 min break, ingen målinger, alt koblet fra				
<u>Pelicasen</u>	2	Gul/PT1	66	63
<u>Pelicasen</u>	2	Sort/PT2	-93	-89
<u>Pelicasen</u>	2	Gul/PT1	42	48
<u>Pelicasen</u>	2	Sort/PT2	-88	-87
Python	2	Gul/PT1	75	38
Python	2	Sort/PT2	-133	-124



3. Comparison in-situ vs redox probe

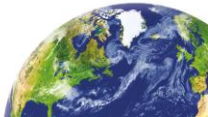
-What's the right way to measure?

- By continuously moving through the formation and measuring instantly after the Pt is exposed to the environment?
- Or by introducing the Pt into the environment and letting it evolve?

-There's no direct way of knowing!

-We can only infer the right answer by comparing the different redox potential measurements with other parameters associated with oxidated/reduced environments such sediment colour, dissolved oxygen, or **nitrate reduction**

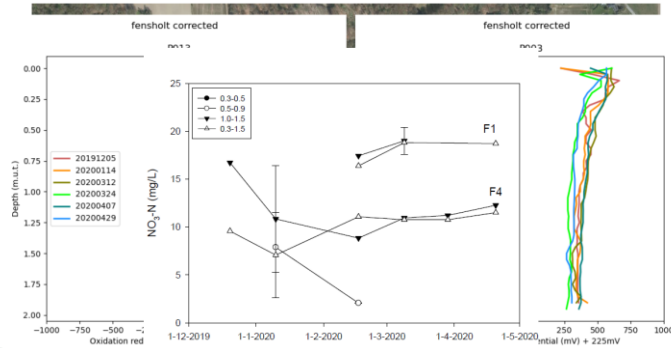
-We await on nitrate data interpretation and comparison with in-situ and redox probe to extract a conclusion in T-Rex



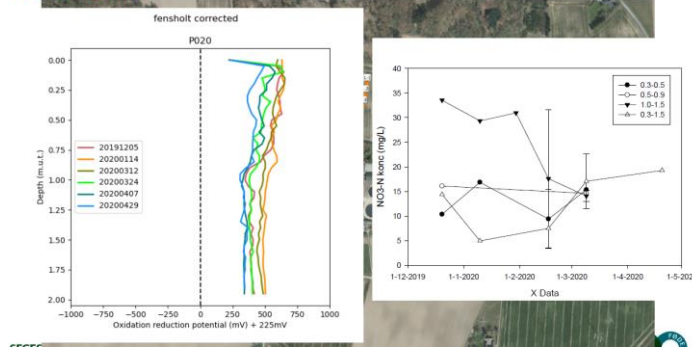
3. Comparison in-situ vs redox probe

-Meanwhile....

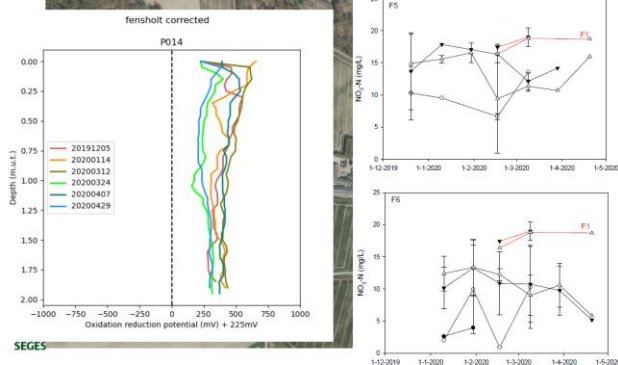
Fensholt F1 & F4



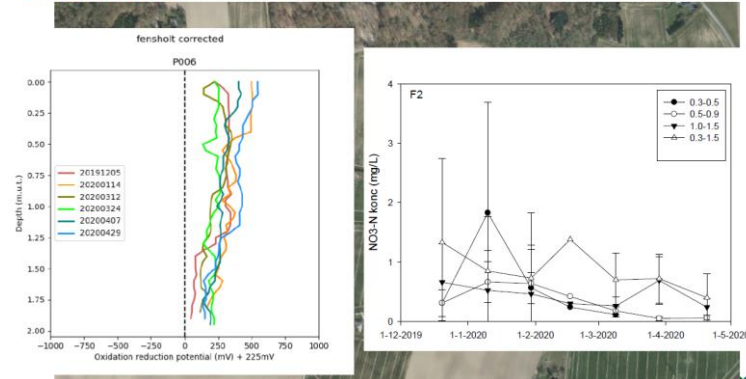
Fensholt F7



Fensholt F5 & F6

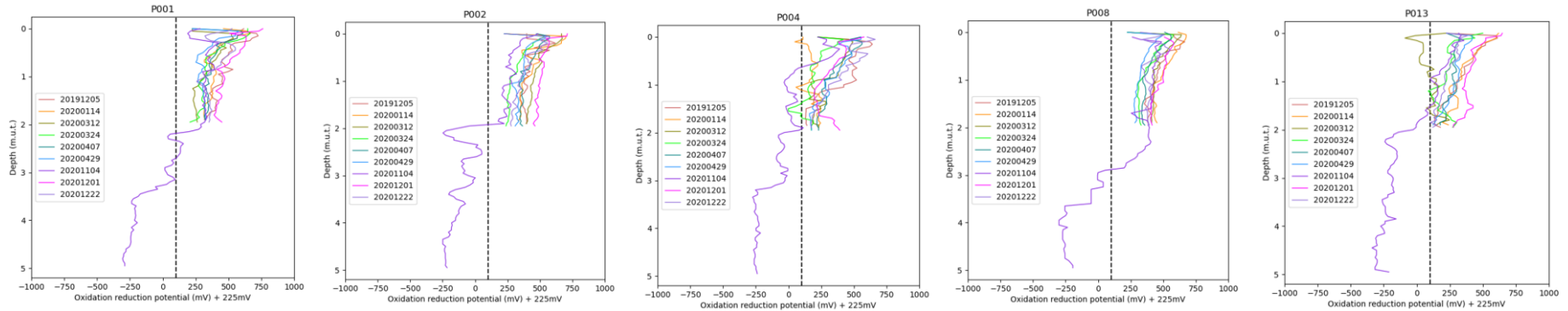


Fensholt F2



3. Comparison in-situ vs redox probe

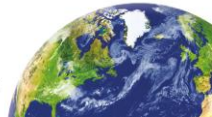
-Fensholt down to 5m: november 2020



Dear Ivan

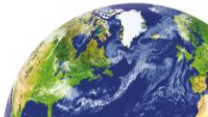
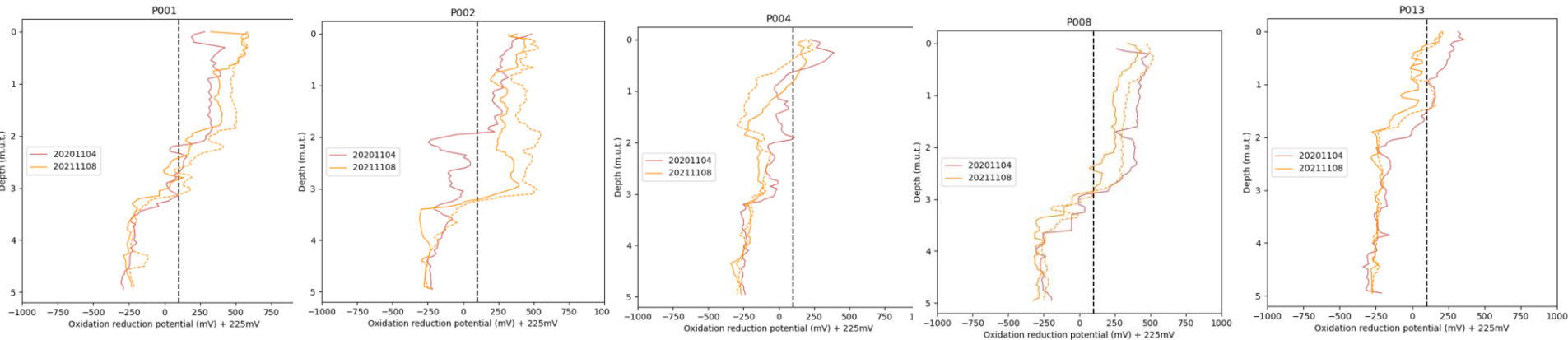
Interesting profiles 😊

I have attached some figures on my paper on data from the field in Fensholt – which shows that the nitrate disappears somewhere between 2.5 and 4.5 – and that the depth varies over time – which may imply that you should not expect “absolute” reproducibility when repeating the measurements.



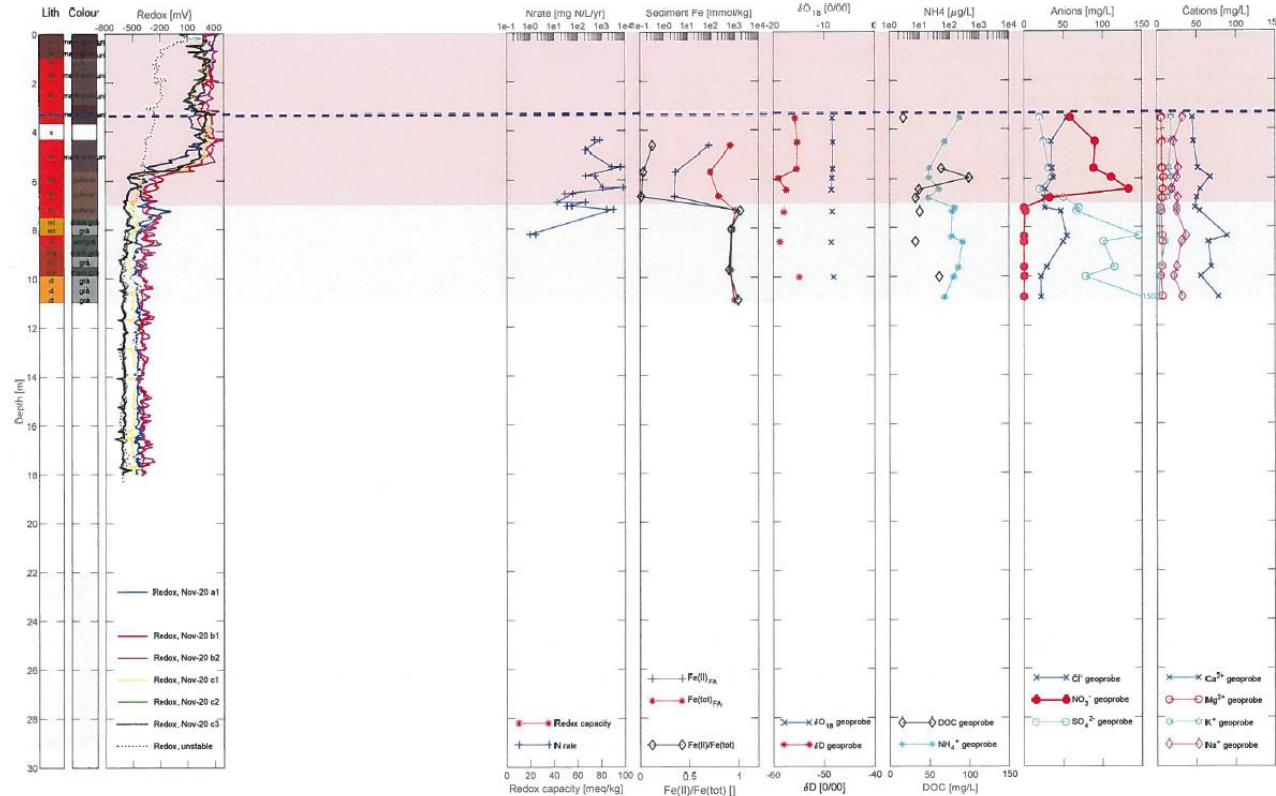
3. Comparison in-situ vs redox probe

-Fensholt down to 5m repeated: 1 year after and with **Dual Redox**



3. Comparison in-situ vs redox probe

-Meanwhile....



Data from
Mapfield.
Anonymous
borehole

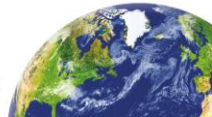


3. Comparison in-situ vs redox probe

-hypothesis on why in-situ measurements could not reflect real redox conditions in relation to the redox probe:

From Ejlskov's experience, we do have the suspicion that the Pt electrode only measures at the very immediacy of its surroundings –mm or um-. Thus, when introducing a "dead end" Pt electrode in a plastic, non hydraulically conductive material like some parts of the pseudogley, the mere insertion of the Pt rod in the sediment is creating a niche environment that has it's own artificial redox ,uncoupled from the surrounding redox.

Some researches might have got the idea that the in-situ electrodes are the way to go, since they have installed them in non-plastic and hydraulically conductive materials like sand. There is even a company in Holland providing in-situ redox measurements! MVH Consult



4. Future plans: where is redox going in TRex?

-Still hope for some nitrate reduction in the root zone. There might come some research publications?

-Trex tractor's leasing contract ends in May 2022: is it the fastest boring tractor?





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