EJLSKOV
Cleaning up the earth

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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?

Ministeriet for Fødevarer, Landbrug og Fiskeri
gudp
STØTTET AF
Promilleafgiftsfonden for landbrug

1. Redox probe development

-Continously 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

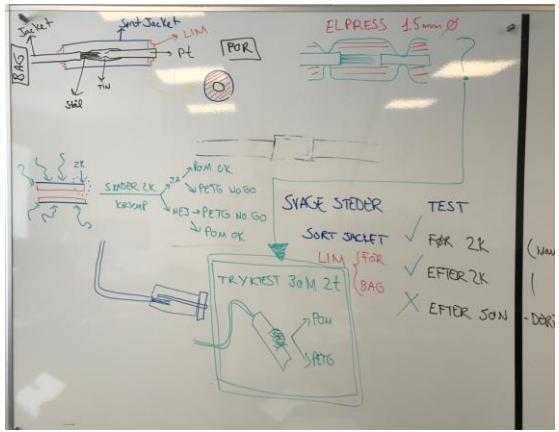
1. Redox probe development

-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!

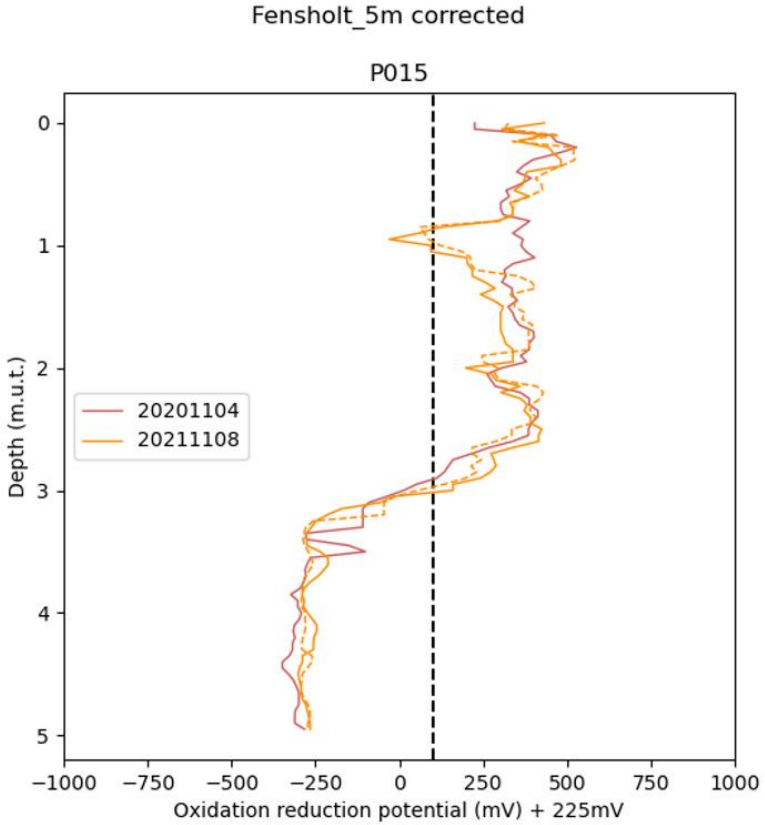


1. Redox probe development

-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

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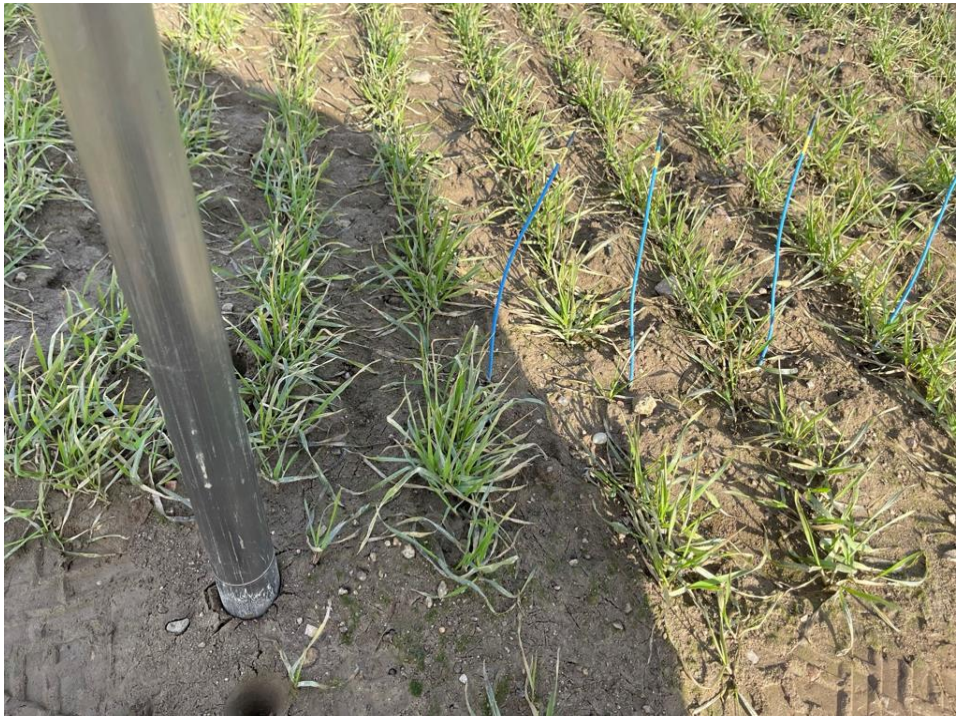
-How?
- 4 depths: 50, 100, 150 & 200 cm
- 2 duplicates each depth
- 3 distances each duplicate
- 3 last measurements
3 different instruments



3- Comparison in-situ vs redox probe

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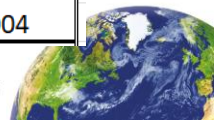
-3 redox probe measurements close to 3 ofthe dates

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			
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		P001
21-50-1	-254			-224			-319			
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	P004



3. Comparison in-situ vs redox probe

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-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

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

3. Comparison in-situ vs redox probe

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-What's the right way to measure?

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

-There's no direct way of knowing!

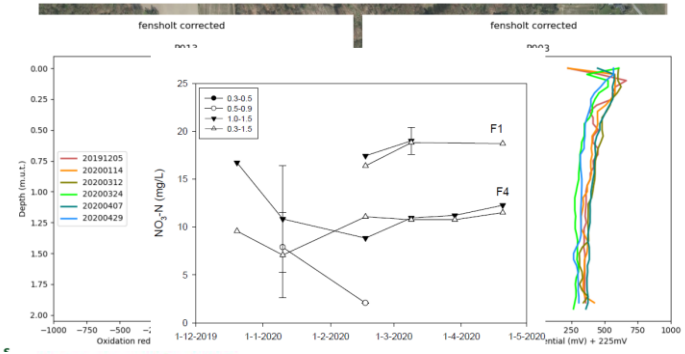
-We can only infere the right answer by comparing the different redox potential measurements with other parameters associated with oxidated/reduced environments such sediment colour, disolved oxygen, or **nitrate reduction**

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

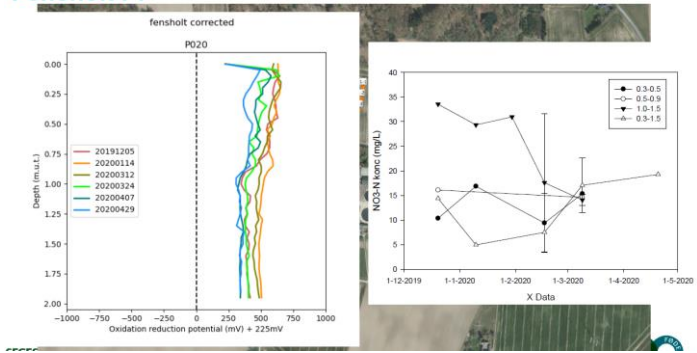
3. Comparison in-situ vs redox probe

-Meanwhile….

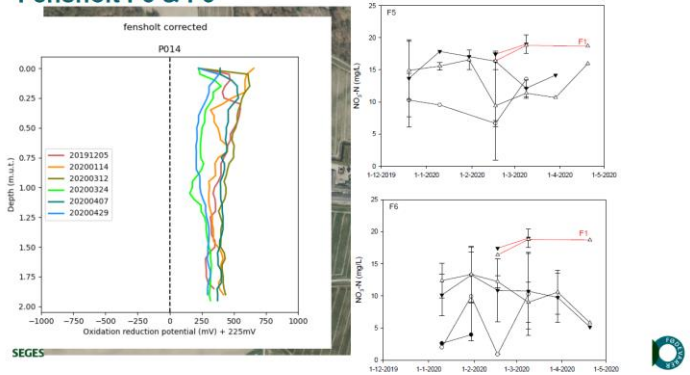
Fensholt F1 & F4



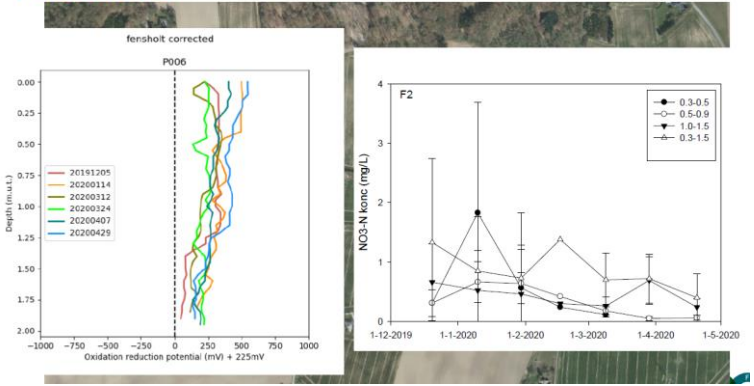
Fensholt F7



Fensholt F5 & F6



Fensholt F2



3. Comparison in-situ vs redox probe

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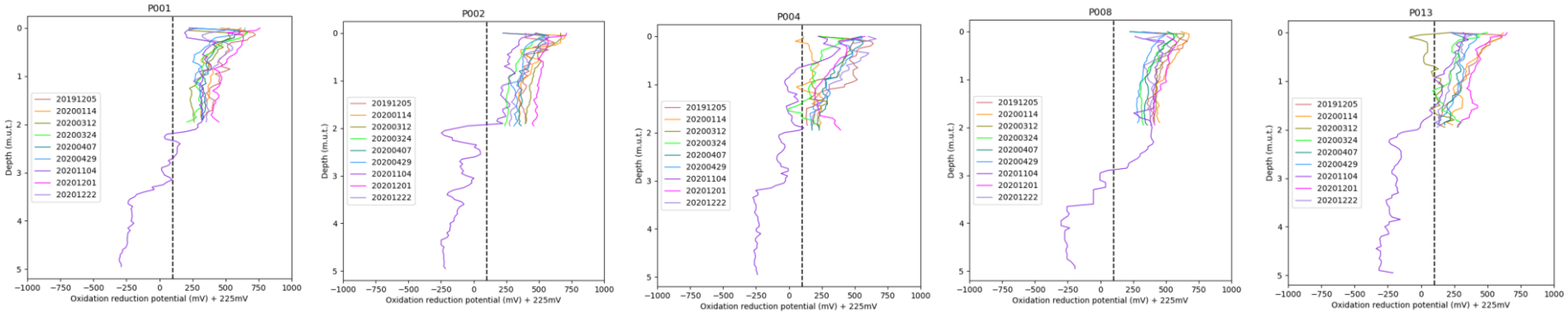
-Fensholt down to 5m: november 2020



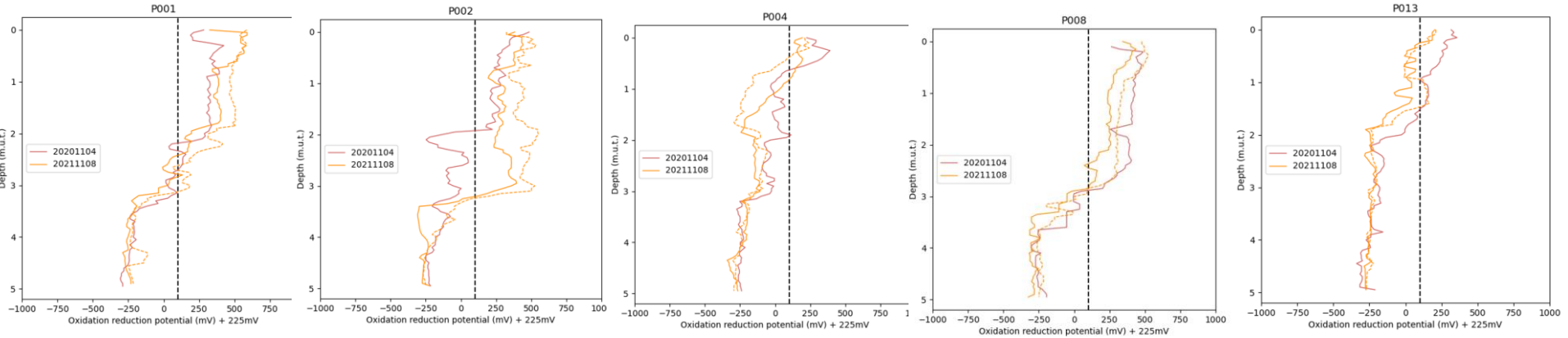
Dear Ivan

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 implie that you should not expect “absolute” reproducibility when repeating the measurements.

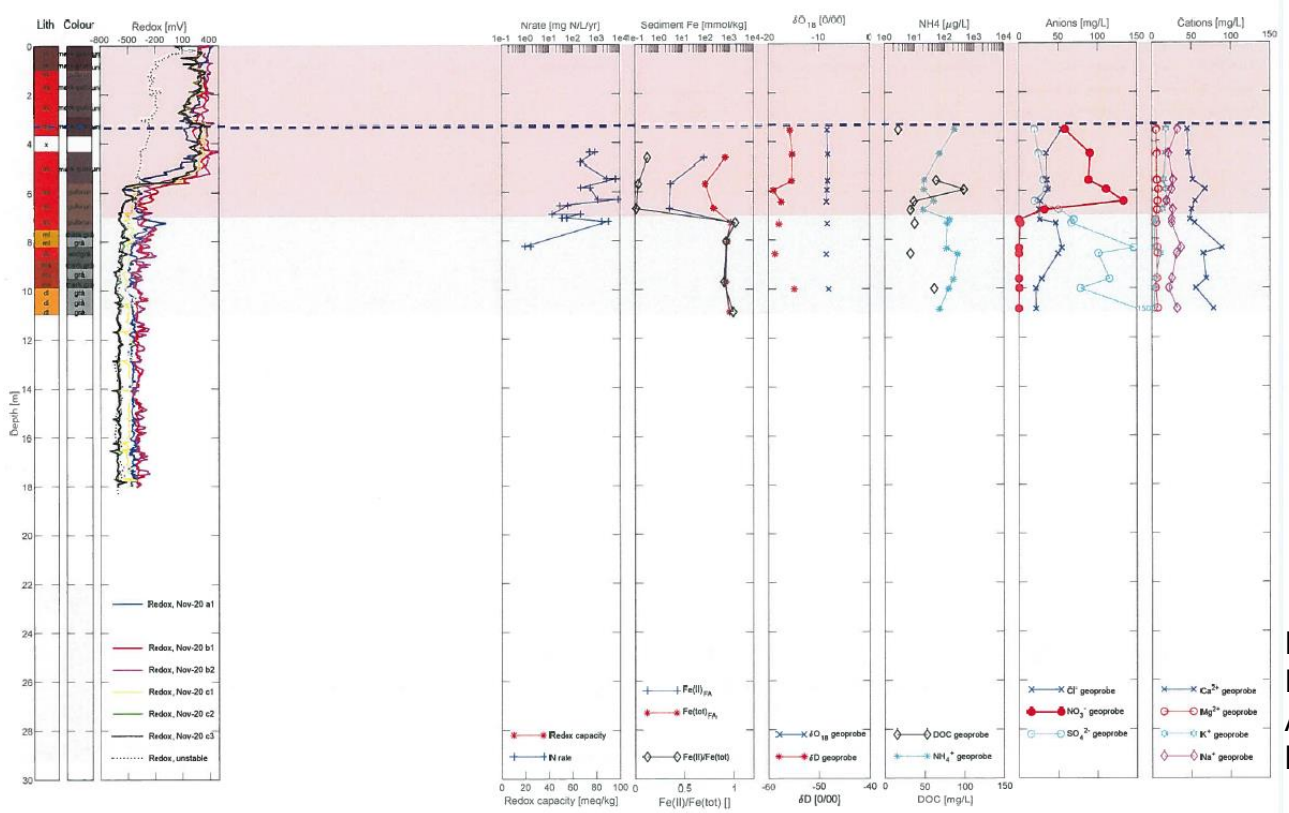
3. Comparison in-situ vs redox probe

-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 inmediacy of its surroundings –mm or um-. Thus, when introducing a "dead end" Pt electrode in a plastic, non hydraulicaly 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 condutive 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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