



# Tracing *Hanneke Vrome* numerically

Dyalog '20 meeting for  
the APL computer programming language

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2AMOT  
+  
O

75000 years ago

552 years ago

3 million years ago

15000 years ago

51 years ago

**Anno 1468**

**Medieval ship Hanneke Vrome goes under**

Grab your pr0blem, go attak it!

Extend your mind with APL!

It's never a waste of time!

# Why do this?

Historical importance

(medieval = extremely rare)

Logical, numerical & practical challenge

(perfect fit for APL)

Items on board

(gold for example)



# Detailed political map Anno 1468





# Travemünde



Timmendorfer  
Strand

Ratekau

NSG  
Schellbruch

Karlshof

SCHLUTUP

ST. GERTRUD

LÜBECKER  
ALTSTADT

Lübeck

Museum Holstentor  
Tillfälligt stängt

Dom zu Lübeck

Hotel Kaiserhof

Google

Traveller Ho



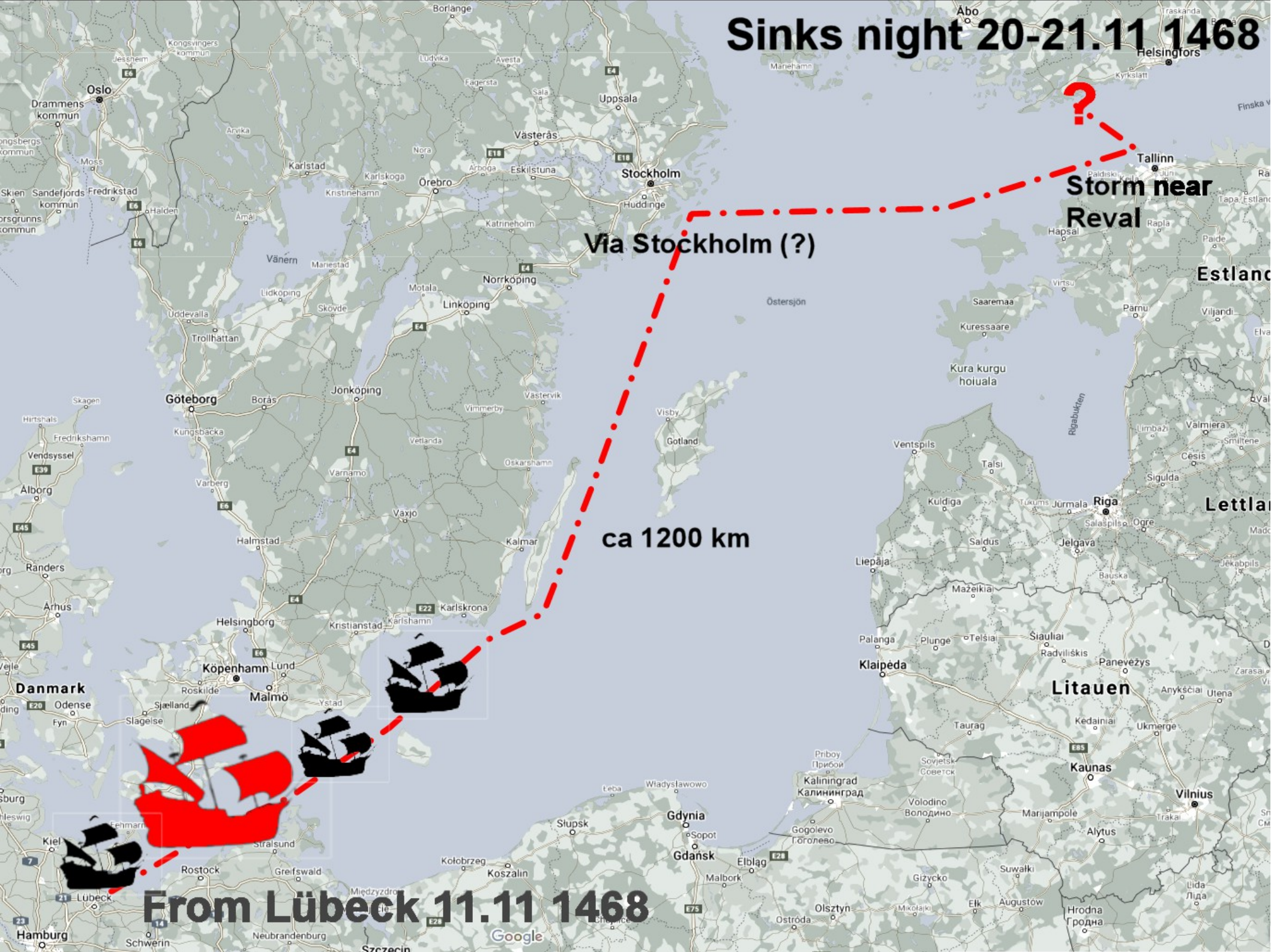
# Captain **Hanneke Vrome**'s ship (with same name):

- Length 40 - 45 meters (?)
- Mass 500+ tonnes (loaded) (?)
- Draft 4 - 5 meters (?)





**Sinks night 20-21.11 1468**



**Via Stockholm (?)**

**ca 1200 km**

**Storm near  
Reval**

**From Lübeck 11.11 1468**



Reval (Tallinn, Estonia)  
Painting by Petr Petrovich Vereschagin  
1850 - 1900

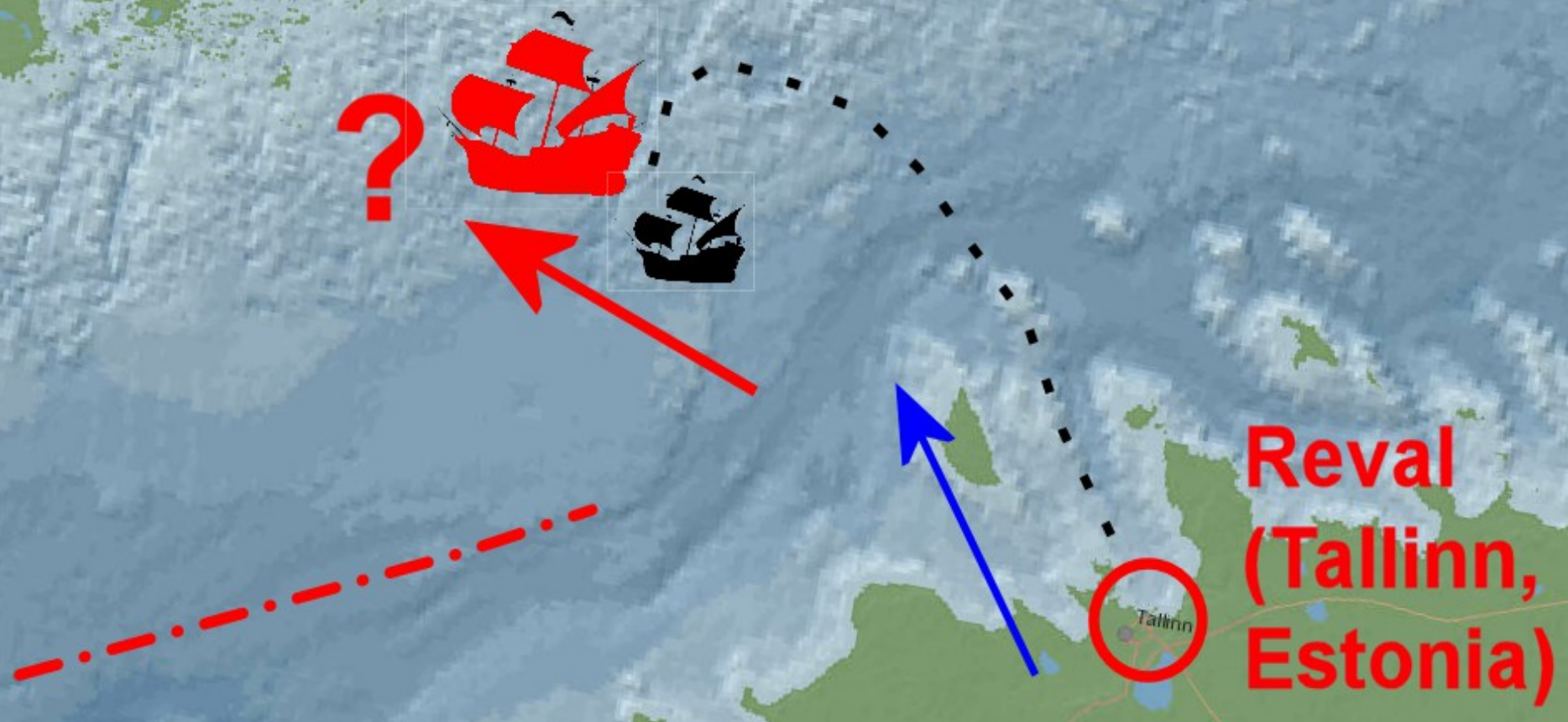








# Stormy wind problem



# Severity

27,000,000 Scandinavian population now

÷ 1,690,000 Kalmar Union population in year 1500

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15.98

220 Casualties in the Hanneke Vrome accident

× 15.98

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3515

(Estonia: 852)



# Raseborg castle, built ca 1373











5 km



Raseborgs Slottsruiner

Pojo

Ekenäs

Leksyall

Gullö

Skärlandet  
Skäldö

Ekenäs  
skärgårds  
nationalpark

Torsö

Rösund

Briggharudjupet

Storramsjö

Barösund

Orslandet

Älgsjölandet

Fågervik

Karls

Bilnäs

Äminnefors

Fiskars

Backgränd

Mjölbolsta

Svartå

Kusans

Täkter -

Ingars

Ingå

Tenala

Grabbskog

Harparskog

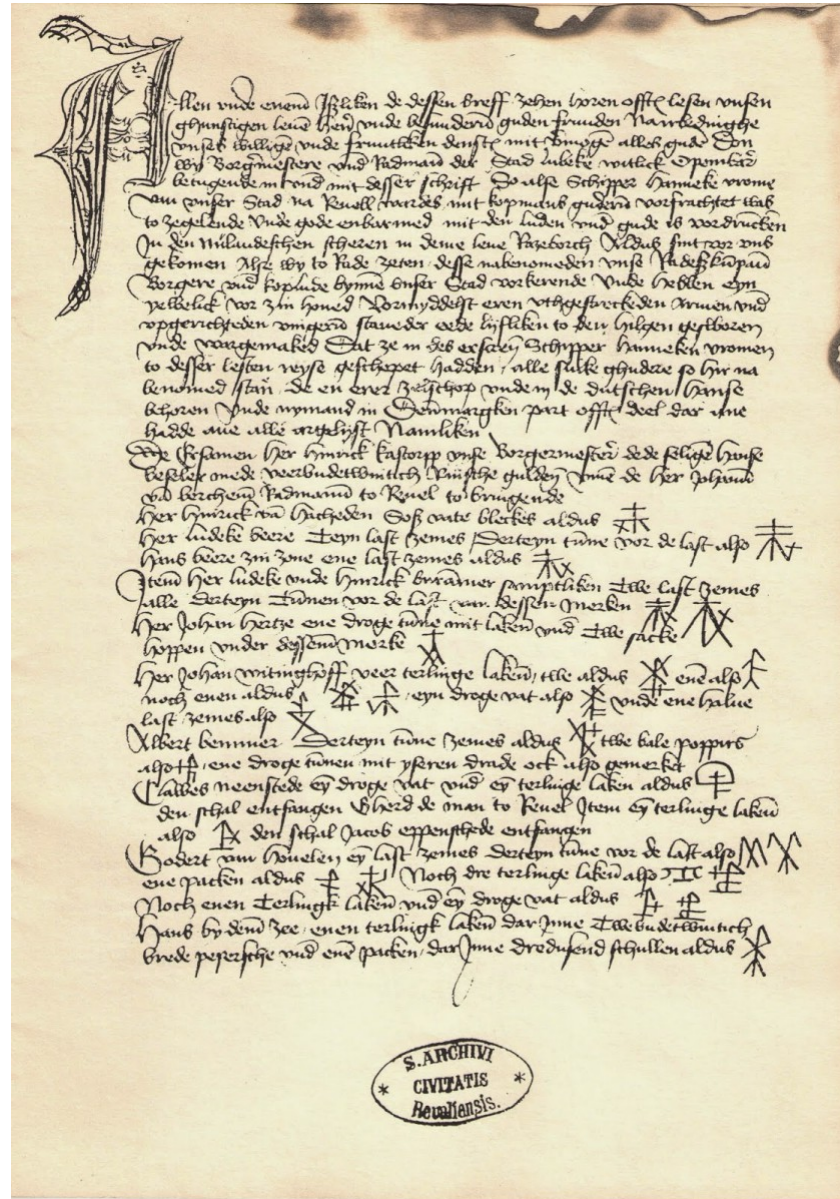
Skogby

ppvik

Parameters at hands



# 1/11: The document



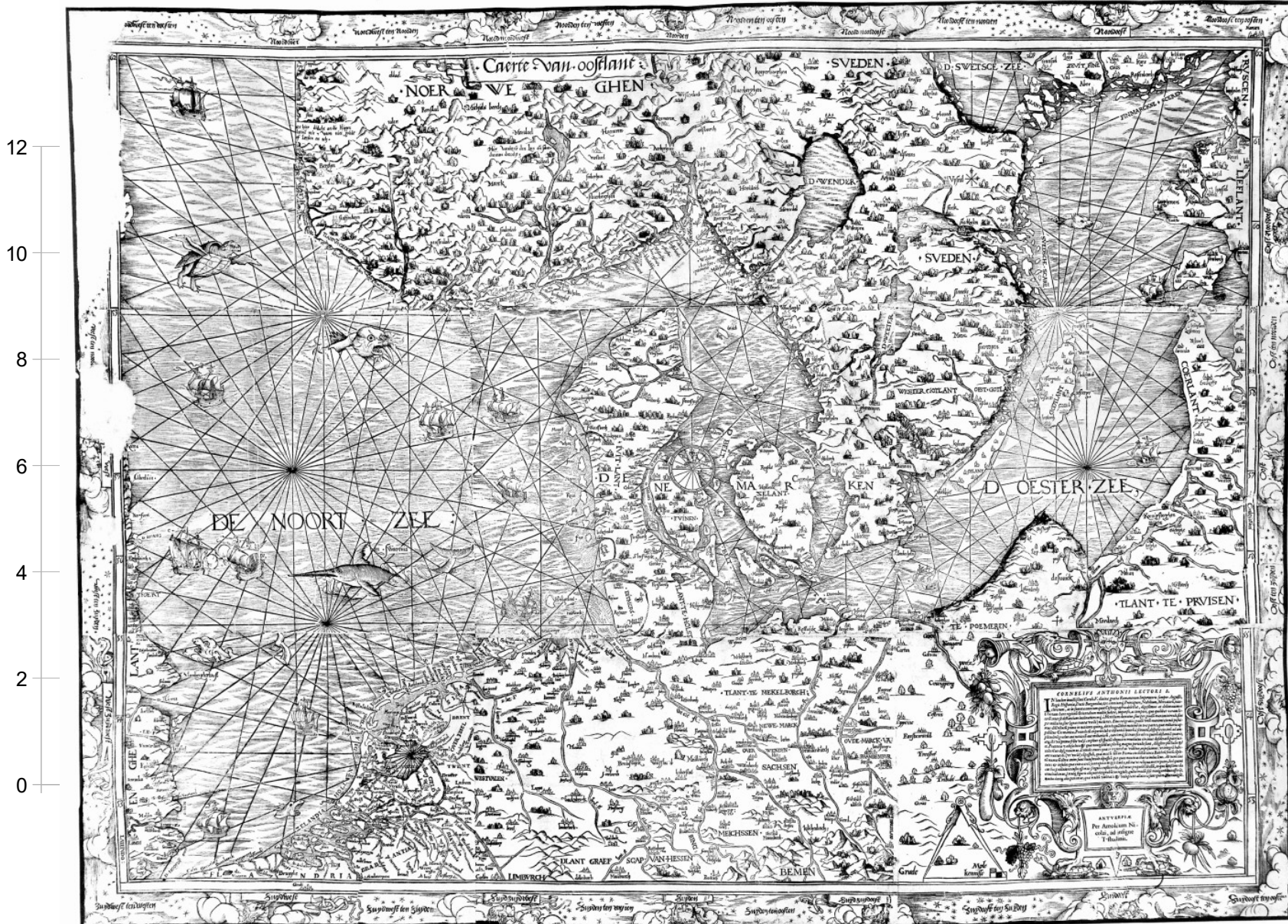
The other ship  
survived!

Told the story!



# 2/11: Portolans (useless, mostly)

## Caerte van Oostlant Woodcut 1543.jpg





"King Valdemars sailing route", ca 1230



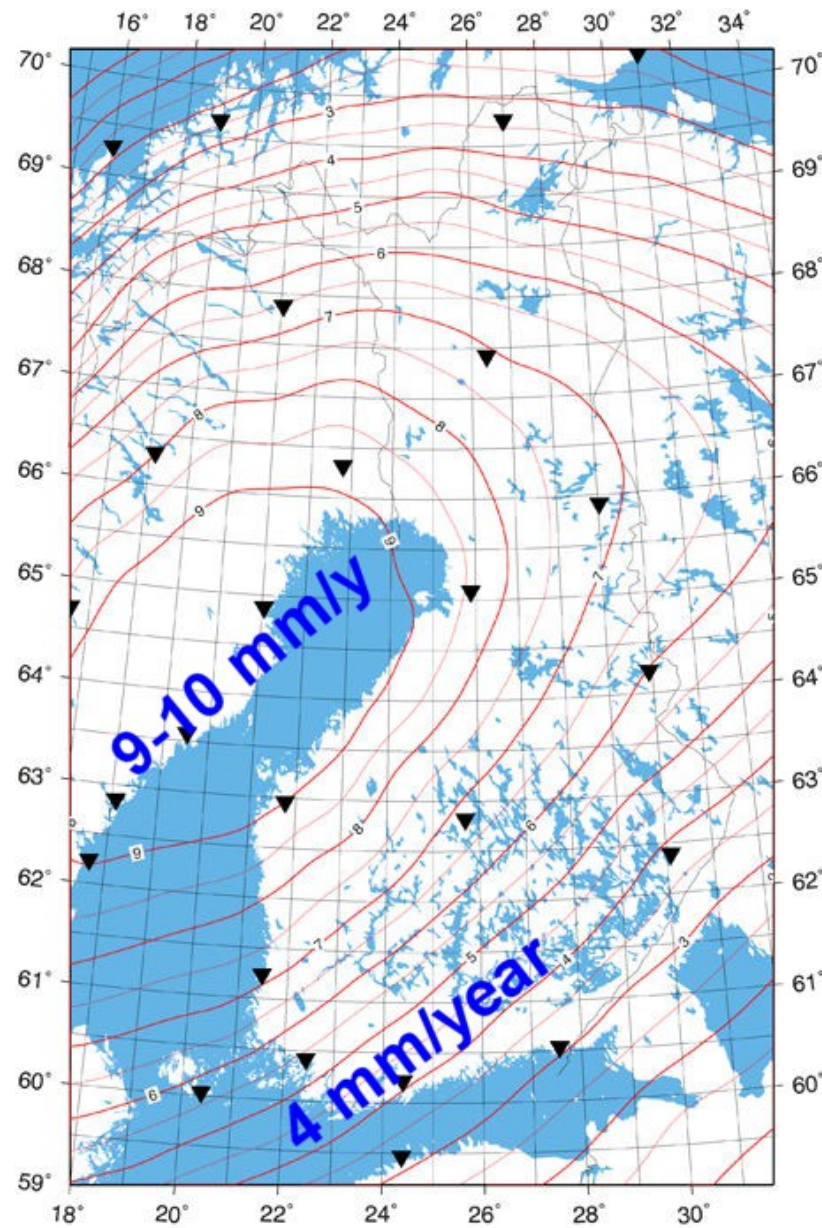


12000 years ago



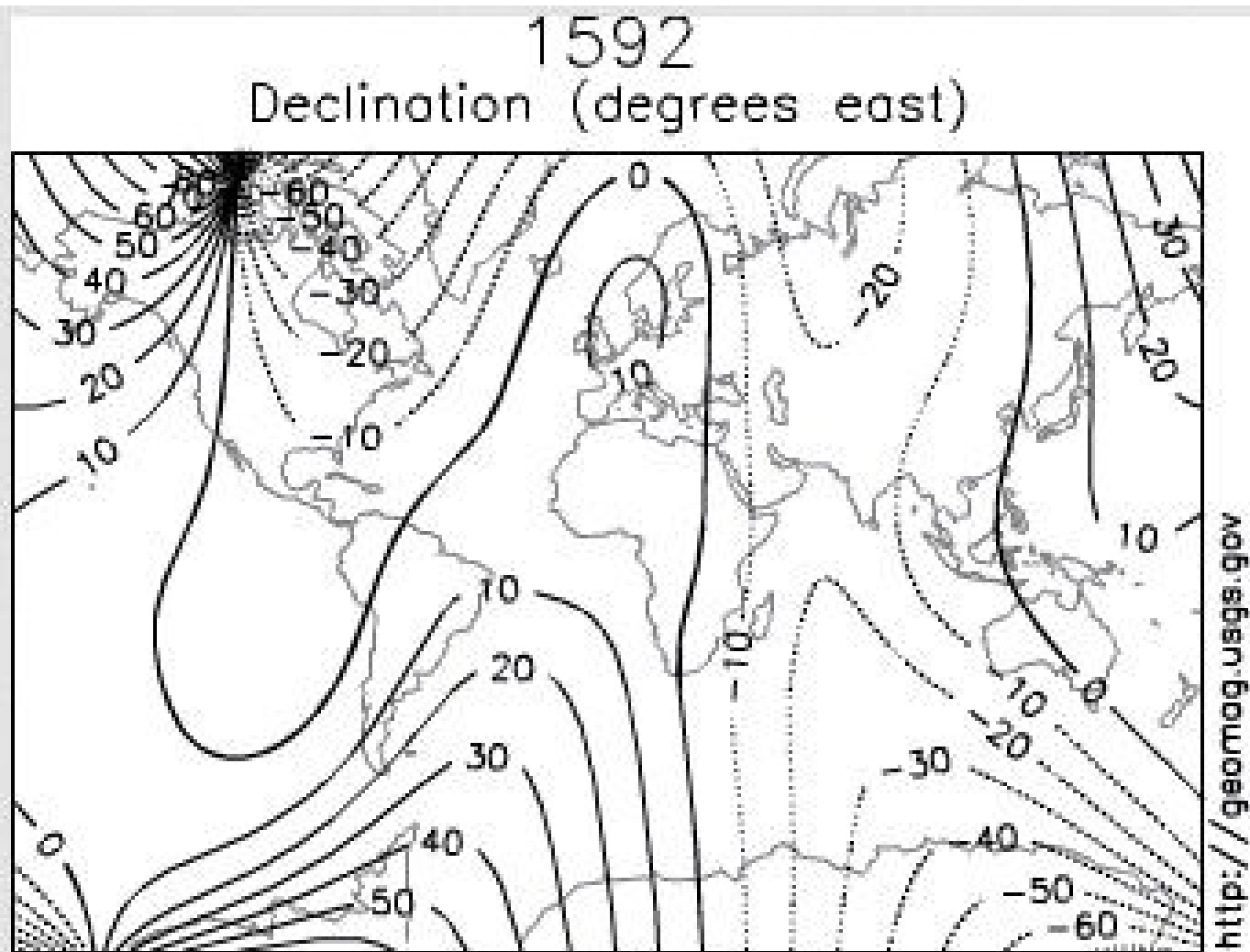
# 4/11: Raising land

From last ice age, ca 10000BC =>





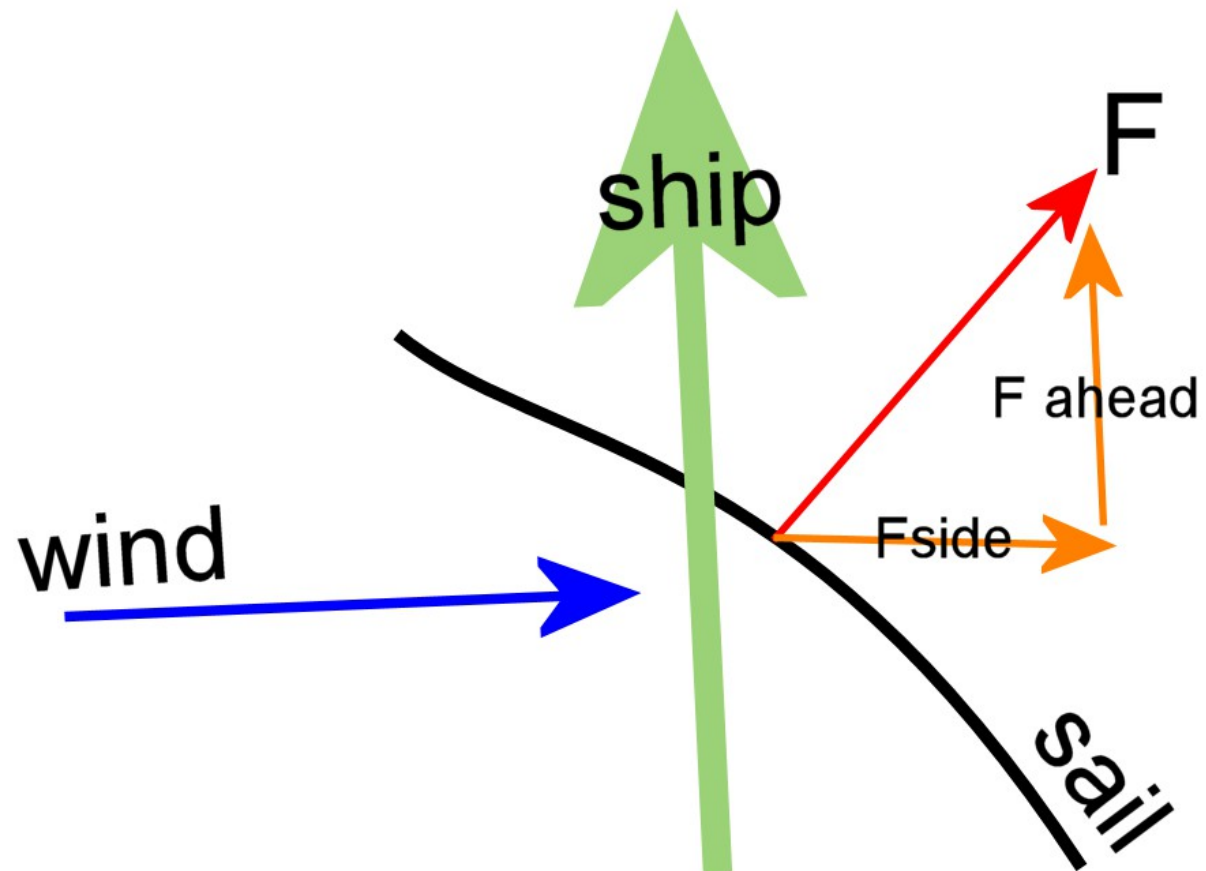
## 5/11: Magnetic error



Model by A. Jackson, A. R. T. Jonkers, M. R. Walker,  
Phil. Trans. R. Soc. London A (2000). 358, 957–990.



## 6/11: Force vectors



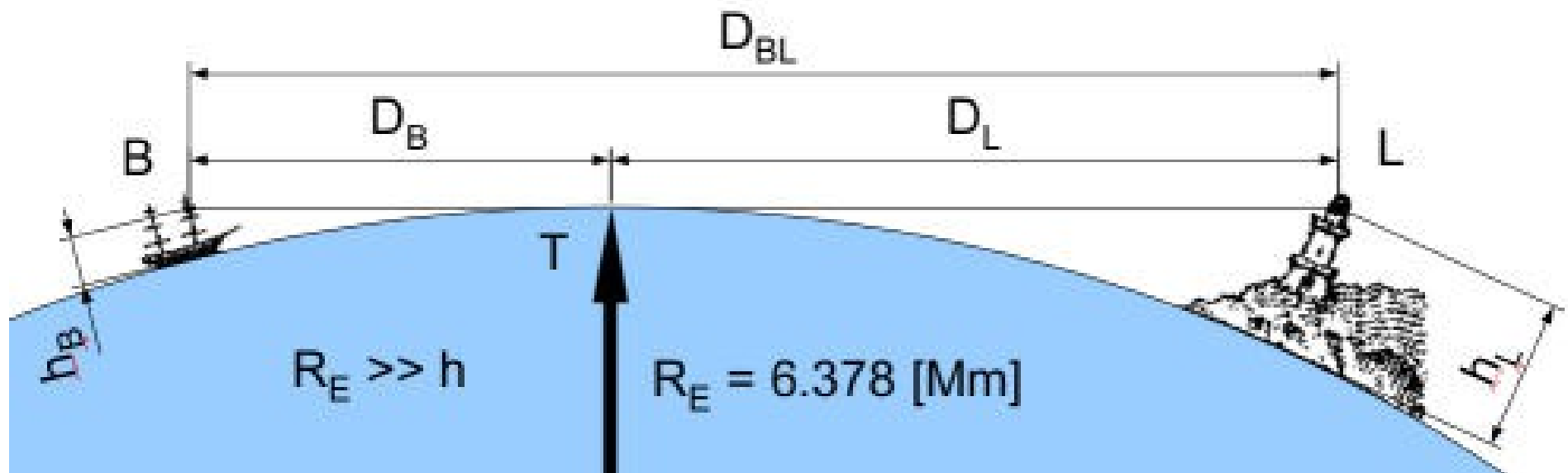


# 7/11: View distance (Example: 30m, 30m => 39 km)

$$D_{BL}[Km] = D_B + D_L = \sqrt{2 \cdot R \cdot h_B + h_B^2} + \sqrt{2 \cdot R \cdot h_L + h_L^2} \sim 3.57 \cdot (\sqrt{h_B} + \sqrt{h_L})$$

$$D_L[Km] = \sqrt{2 \cdot R \cdot h_L + h_L^2} \sim \sqrt{2 \cdot 6.378 \cdot h_L} = \sqrt{12.756 \cdot h_L} = 3.57 \cdot \sqrt{h_L}$$

$$D_B[Km] = \sqrt{2 \cdot R \cdot h_B + h_B^2} \sim \sqrt{2 \cdot 6.378 \cdot h_B} = \sqrt{12.756 \cdot h_B} = 3.57 \cdot \sqrt{h_B}$$





8/11:

## "No survivors" vs. water temperature & current

Water temperature	Time until unconsciousness	Time until death
0	< 15 min	15 - 45 min
0 - 5	15 - 30 min	30 - 90 min
5 - 10	30 - 60 min	1 - 3 hours
10 - 15	1 - 2 hours	1 - 6 hours
15 - 21	2 - 7 hours	2 - 40 hours
21 - 27	3 - 12 hours	3 hours +

## 9/11: Human behaviour

- False fires of guidance
- Money
- Hurry
- Demanding passengers (Raseborg castle lord's wife & son)
- Not sailing at night
- Fear, **Godfear**
- Experience



10/11: Weather

# **EU "Copernicus" weather analysis programme**

(browser & APL)

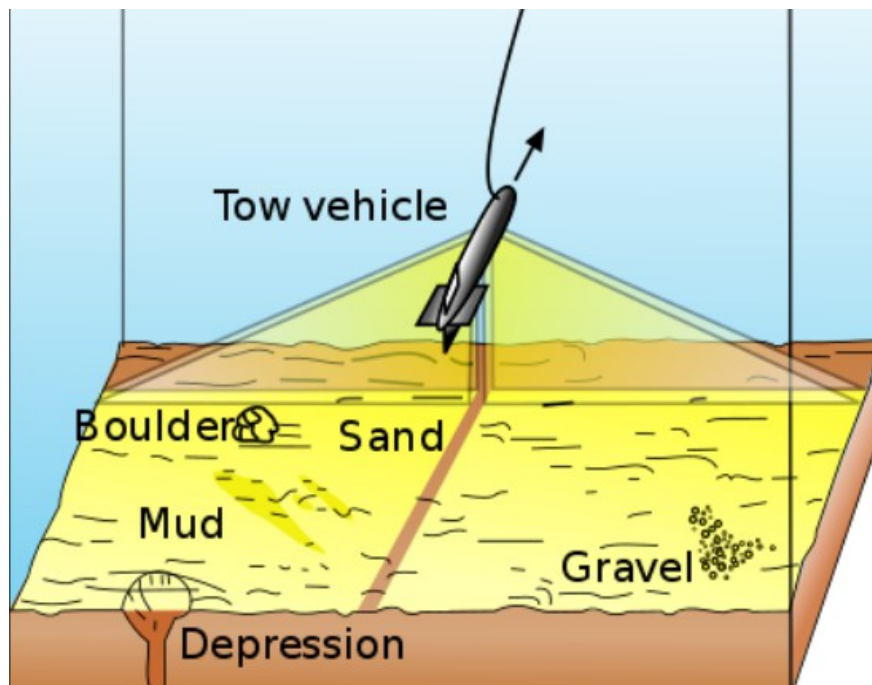
# 11/11: Geospatial data

## **New Stormwind data**

(APL)



# 12/11: Tomas vs. law



## Territorial Surveillance Act

### 12 §

*Undersökning och kartläggning av havsbotten*

*På Finlands territorialvatten får utredningar som gäller formen eller sammansättningen av eller strukturen hos havsbotten eller dess inre inte utan tillstånd företas med hjälp av geologiska eller geofysiska undersökningar, inte heller får havsbottnens topografiska former mätas och registreras systematiskt.*

**Systematic documentation of seabed == very forbidden!**

# Simulation (APL)

## Trip Planner:

Start N 53°47'19" - E 7°03'32"

Finish N 53°47'19" - E 7°03'32"

Distance 2145.15 nm

Course	Distance	Coordinate
1. 81.46°	745.13 nm	N 53°47'19" - E 28°08'30"
2. 0.00°	386.11 nm	N 60°13'08" - E 28°08'30"
3. 274.62°	317.16 nm	N 60°13'08" - E 17°29'46"
4. 274.53°	310.63 nm	N 60°13'08" - E 7°04'12"
5. 180.06°	386.11 nm	N 53°47'19" - E 7°03'32"

Download CSV

05.11 1979 09h

Start: 1.11 1:00

Speed: 3.5 kn

Wind: 7.6 m/s

4 days 8 hrs

Dist: 4 M



So where is it?

