Project, Funding, Participants

› GEOCENTER project (2011-2014) including a PhD project

› Funding and financial support:
  › Geological Survey of Denmark and Greenland (GEUS)
  › Aarhus University (AU)
  › International Medical Geology Association (IMGA)
  › International Registry of Pathology (IRP) – Gardner Research Grant

› Project participants:
  › Søren M. Kristiansen (AU)
  › Birgitte Hansen, Vibeke Ernstsen, Brian L. Sørensen, Kim H. Ebbesen (GEUS)

› Collaborations:
  › Chaosheng Zhang (NUIG Galway, Ireland), Jörg Schullehner and Lisbeth Flindt-Jørgensen (GEUS), Nikoline Nygård Knudsen and Annette Kyar Erbsell (University of Southern Denmark).

We would like to thank the Danish water supply companies that participated in our study (n=89)
Iodine...

... plays an essential role in human metabolism and the early development [1]

... deficiency is the single most important preventable cause of brain damage [2]

... recommended daily intake: 150 µg for adults, 250 µg in pregnancy and lactation [1]

... intake is insufficient for about 44% of the population in WHO Europe region [3]

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Objectives & Data

› To map iodine in Danish DW and GW

› To study the spatial patterns

› To elucidate the governing factors

› To connect DW quality data with health register data

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Source: PhD thesis
Study design

› Criteria
› Water companies involvement
› Sampling: April-June 2013
› Samples from 144 waterworks received to the lab

Results

Total iodine =
  = Iodide
  + Iodate
  + Organic iodine

Concentration < d.l. to 126 µg/L

Iodine speciation, major and trace elements
Spatial variation of total iodine in drinking water

How do we present it?
Optimal conceptual model?

- Interpolation (here IDW) *
- East vs. West ^
- Municipalities ^
- Areas with similar characteristics based on Local Moraine’s I analysis *
- Supply areas of the waterworks *

Sources: ^ Paper 2, * Paper 4

DW contribution to RNI

Exposure from DW

Source: Paper 2

Source: Paper 4
Governing factors

- Geology & hydrogeochemistry
- Groundwater treatment
- Possible effects from the treatment
  - Organic ↔ inorganic iodine
  - Iodine lost to the atmosphere (I₂)
  - Iodine removal in the treatment against ferrous iron

Sources: Paper 2, Paper 3, PhD thesis

Iodine in Danish groundwater (brief summary)

- Heterogeneous spatial distribution at...
  - national scale
  - local scale
  - different depths of the same well/aquifer

- Elevated iodine concentrations...
  - predominantly at depths >40 m.b.t
  - in samples of GW older than 25 years (>27µg/L)
  - associated with reduced and alkaline GWs
  - related to the marine origin of the aquifers

- Site and depth specific factors

Sources: Paper 1, Paper 3, PhD thesis
Perspectives

› Combining public health data & DW composition data

› Beneficial or Adverse effects?
  - **Iodine**, Lithium, Strontium (needed funding for continuing the studies)
  - **Nitrate** (see Jörg Schullehner’s poster for details)

› Unique opportunity for register based studies in Denmark, however...
  
  Further research is needed
  for identifying and quantifying
  the associated uncertainties

Thank you for listening!

Questions?

References to own work:


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