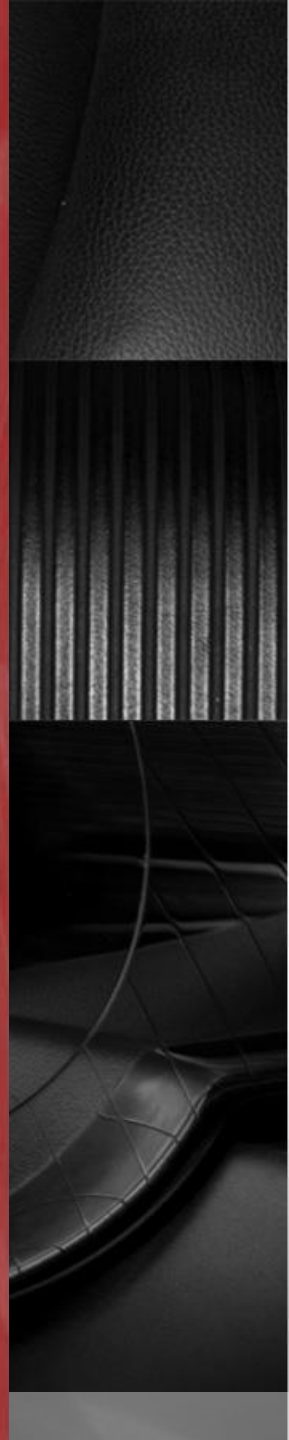


Student Projects concerning Automatic Monitoring of Water Chemistry at Húsavíkurhöfði

Helga Raket Guðrúnardóttir¹ and Hrefna Kristmannsdóttir²

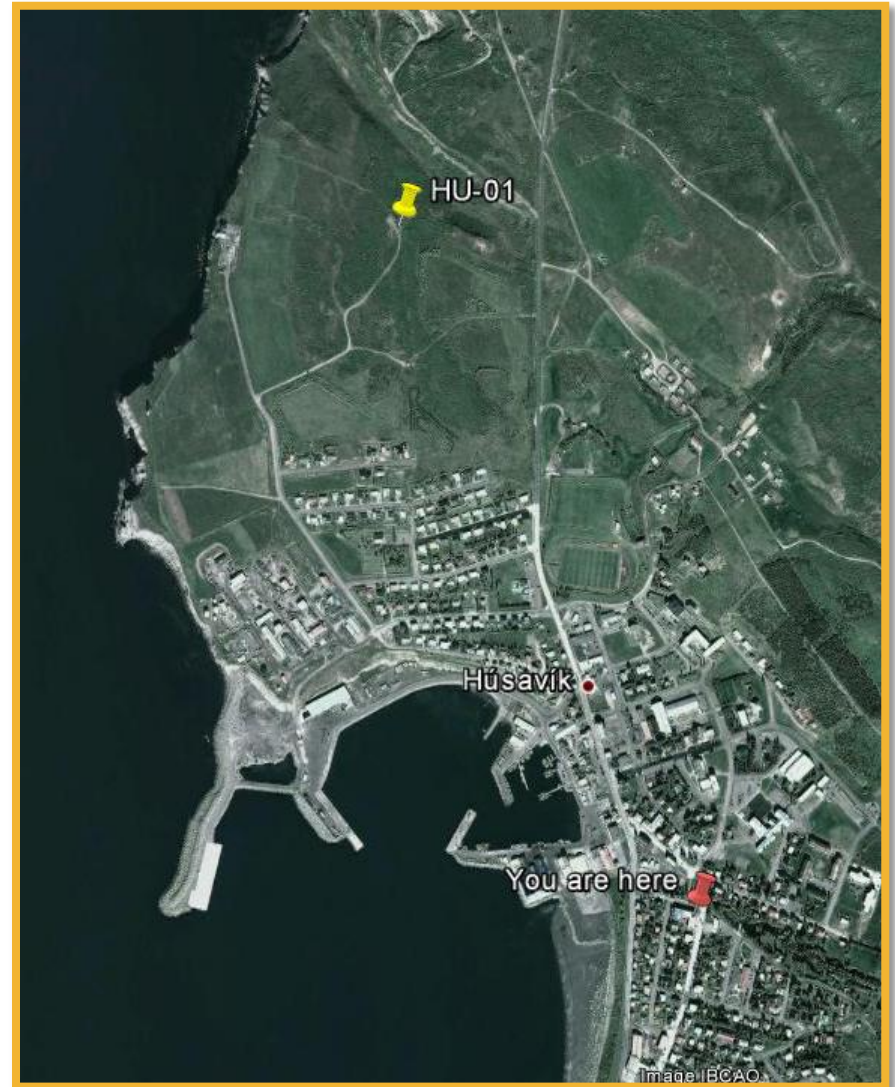
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Background

- Voltammeter set up 8 years ago
- Cooperative research project
 - Stockholm University (SU)
 - University of Akureyri (until 2012)
 - Icelandic Meteorological Office (IMO)
- In Iceland
 - 1 on-going Master thesis project
 - 4 student summer projects



Voltammeter

- Voltammeter installed at Húsavíkurhöfði in 2006 (part of M.Sc. at SU)
- Developed by the Norwegian University of Science and Technology in Trondheim
- **Measured Zn, Fe, and Cu**
- Stopped working after a month
 - Needed to be cleaned regularly, SU unable arrange that at that time
 - Temporarily uninstalled
- In 2009 a summer student project at University of Akureyri aimed at repairing and getting the voltammeter up and running again
 - Concluded as not feasible due to frequent cleaning and high maintenance requirements



Húsavíkurhöfði (85°C)

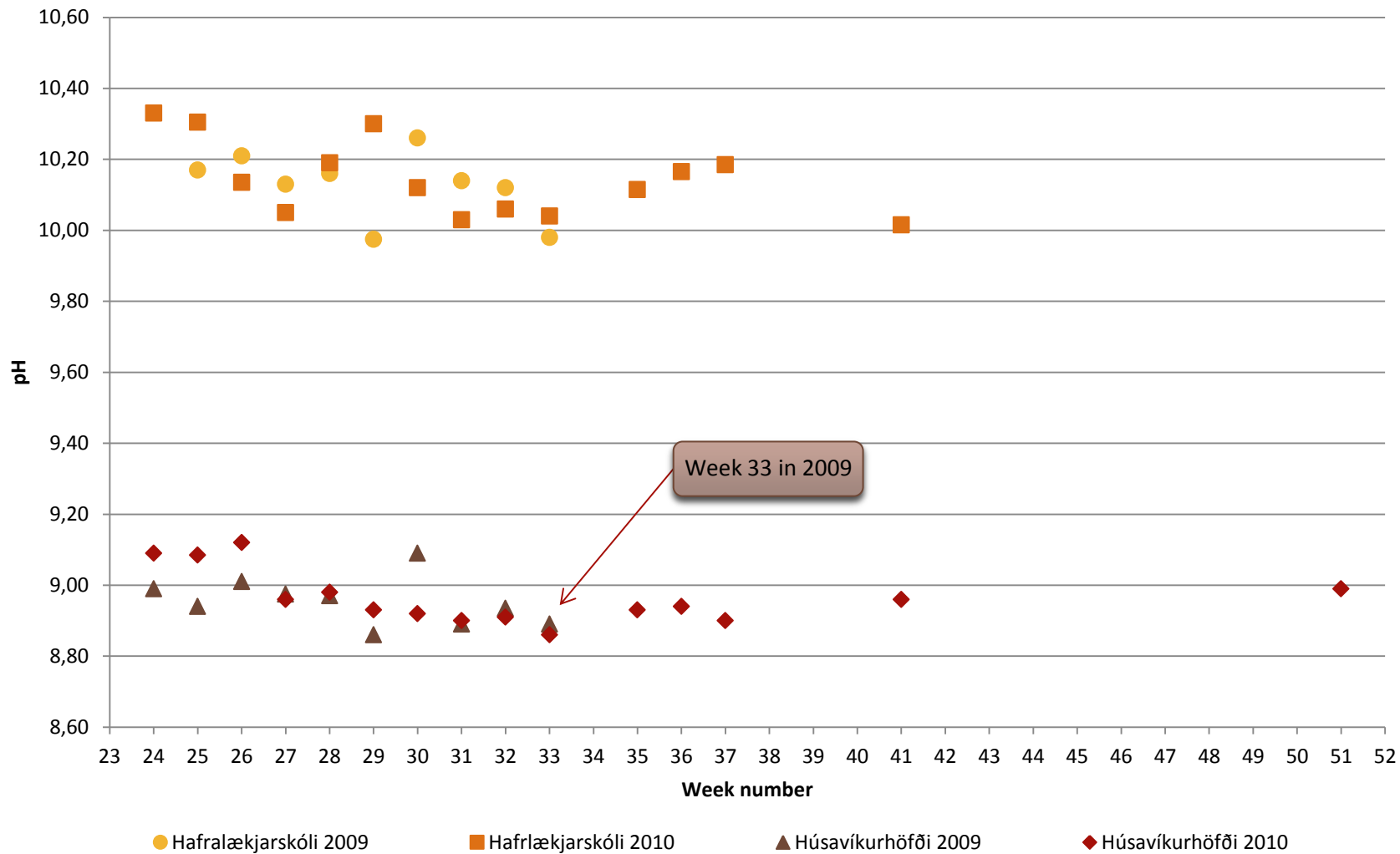
Water level, pH and conductivity



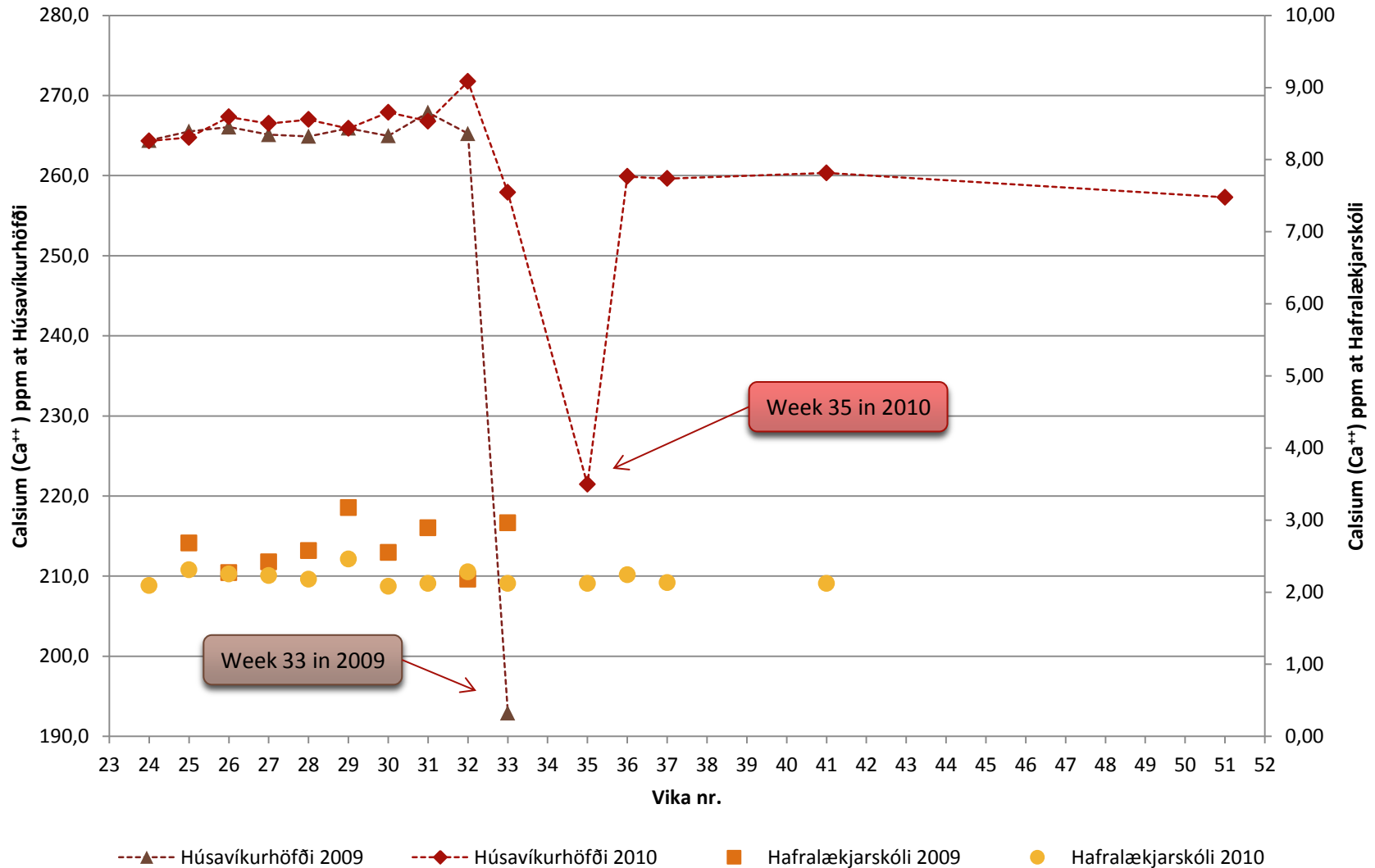
Borehole at Hafralækjarskóli (72°C)

- Water level monitor set up at Húsavíkurhöfði in 2009
 - Due to a misunderstanding the meter used was not heat resistant enough
- Samples taken for pH, bicarbonate, conductivity, Ca and Cl at Húsavíkurhöfði and Hafralækjarskóli
 - Analysed at the University of Akureyri
 - pH and bicarbonate need to be analysed within 3 days
 - Therefore, pH and bicarbonate have not been analysed in the samples collected weekly for the last years
- A summer student project in 2011 looked at using colour indicators and spectroscopy for pH monitoring in hot water
 - Helga Raket Guðrúnardóttir (student) and Andri Stefánson (University of Iceland)
 - More work needed (about 6 months of lab work estimated)

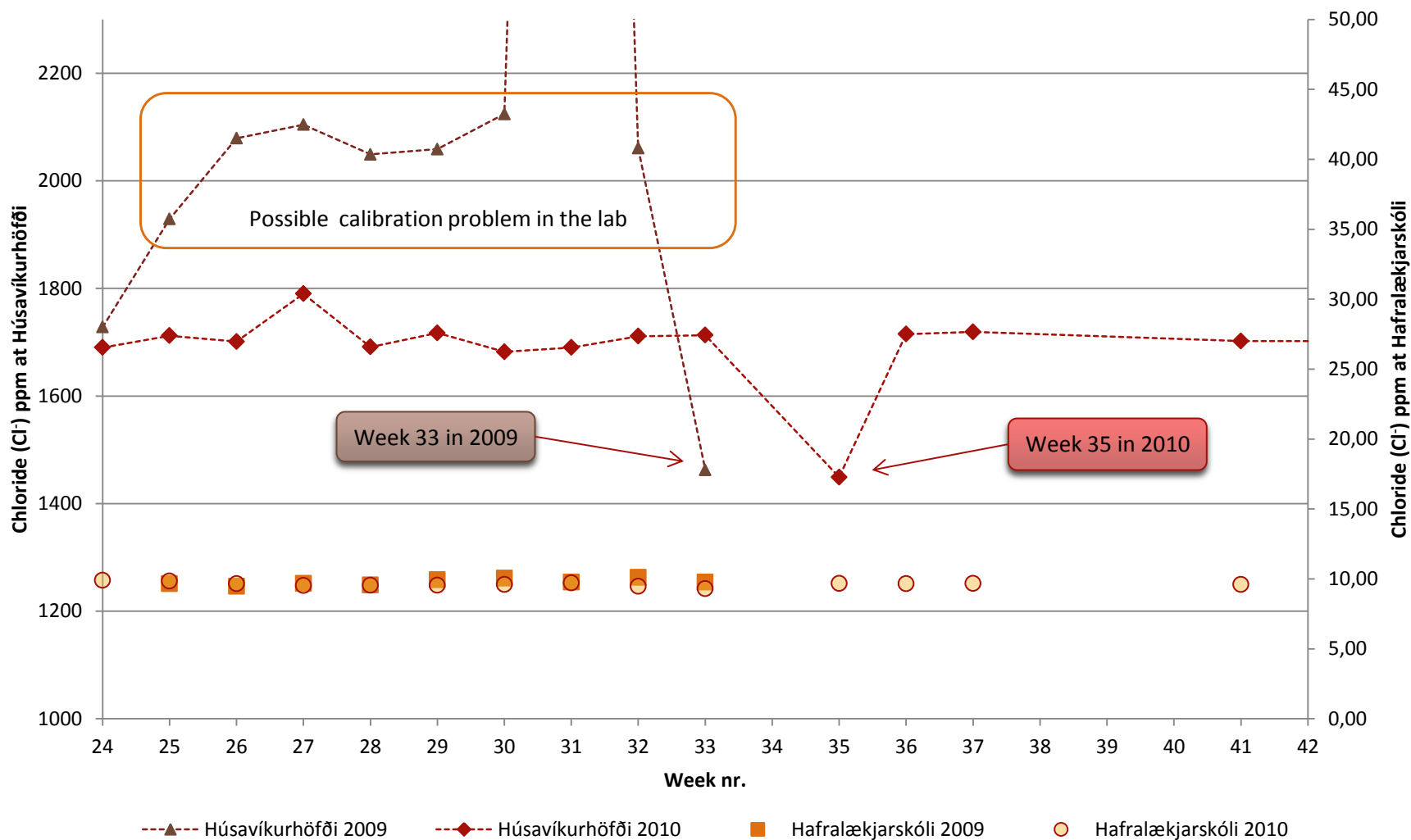
pH at Húsavíkurhöfði and Hafrlækjarskóli in 2009 and 2010



Calcium (Ca⁺⁺) 2009 and 2010



Chloride (Cl⁻) 2009 and 2010



Master thesis

- Master thesis project started in 2009 jointly at the University of Akureyri and Stockholm University
- Subject: Methods of continual monitoring of groundwater chemistry
- The project was delayed due to personal reasons, but has resumed
- Since University of Akureyri no longer has any teaching or research in this field, the master thesis project will be concluded at Stockholm University and the Icelandic Met Office (IMO)

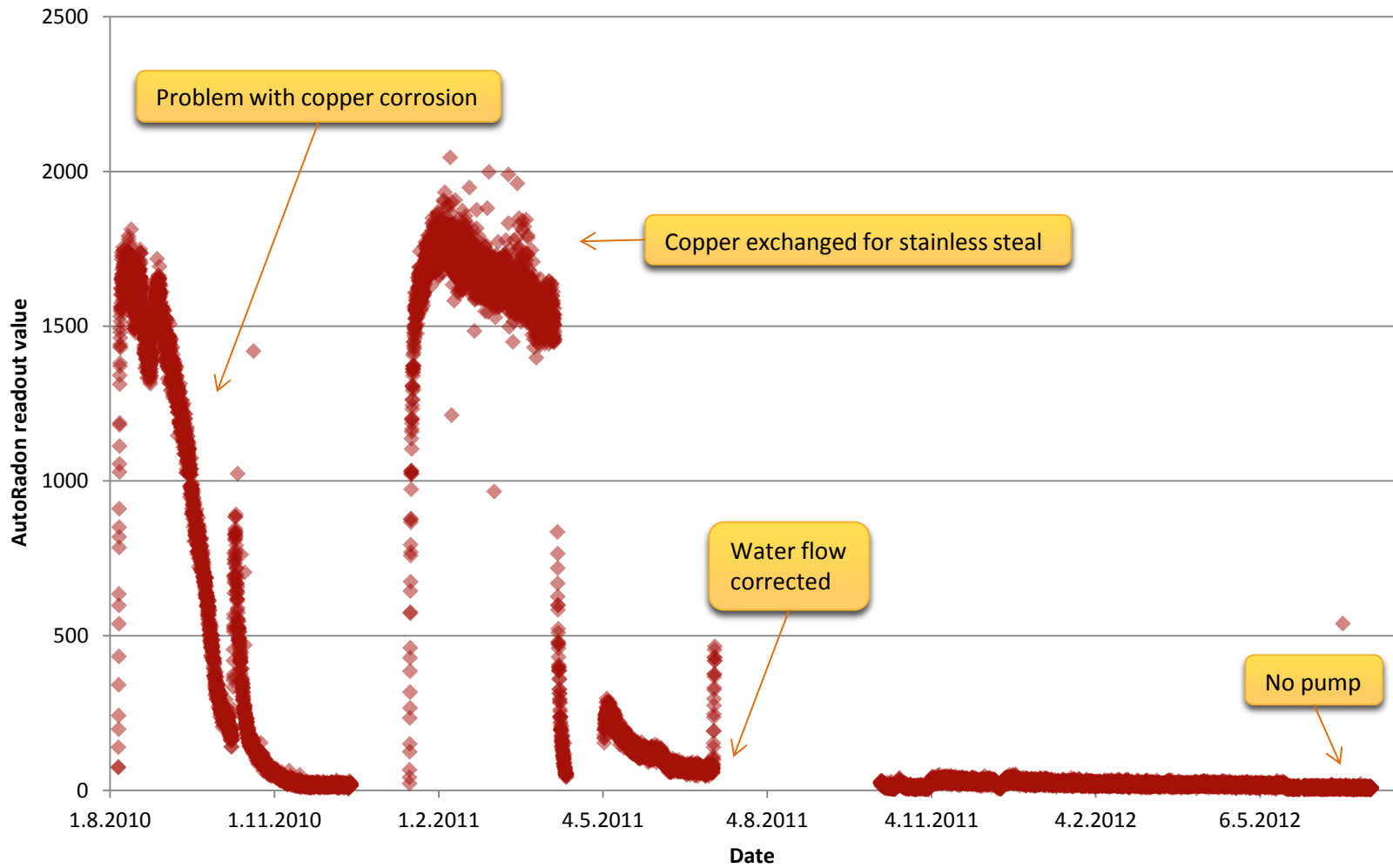


AutoRadon equipment

- AutoRadon equipment developed by Páll Theódórsson at the Science Institute of University of Iceland
- Installed in August 2010 at Húsavíkurhöfði.
- Measurements taken with 1 hour interval, data collected on a USB data key (temporary solution)
- Will be connected to a Datalogger and then connected to the seismic monitoring system of the Icelandic Met Office
 - Summer project this summer
- The equipment itself ran smoothly from 2010-2012
- Several practical problems preventing continuous data collection



AutoRadon at Húsavíkurhöfði





Equipment to be installed in 2013

- Hafralækjarskóli
 - **Data collection** and control - Campbell Scientific CR800 Datalogger
 - **Conductivity and temperature** – Mettler Toledo Sensors and M300
 - **Data transmission** – 2 x Campbell Scientific RF416 Radios and NL100 network link
 - Campbell Scientific 12W power supply and weather-resistant box
- Húsavíkurhöfði (unstable for the last 2 years)/replacement well:
 - **Data collection** and control – Campbell Scientific CR1000 Datalogger
 - **Pressure / Water level** - GEOKON 4500HT - Vibrating Wire High Temperature Piezometer
 - **Conductivity and temperature** – 2 x Mettler Toledo Sensors and M300
 - **Data transmission** – 2 x Campbell Scientific RF416 Radios and NL100 network link
 - Campbell Scientific 12W power supply and weather-resistant box
 - The **AutoRadon** equipment



Next steps

- Decide if we should continue with Húsavíkurhöfði or look for a new site
- If we continue at Húsavíkurhöfði we need to:
 - **Defined communication protocol with other users**
This is because human interference can inhibit data collection and/or obscure seismically-induced signals. With full support from other users we can realize the potential of Húsavíkurhöfði as a unique resource for earthquake monitoring in this seismically active area, which is of obvious benefit to Húsavík town.
 - Run equipment for a year
 - Analyse results and write report / thesis
- Then the IMO will decide if this will be a permanent part of their system