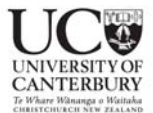


Mine Drainage in Southland

J. Pope, D. Craw and T. Mulliner

Southland Mine Drainage

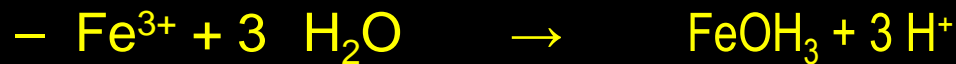
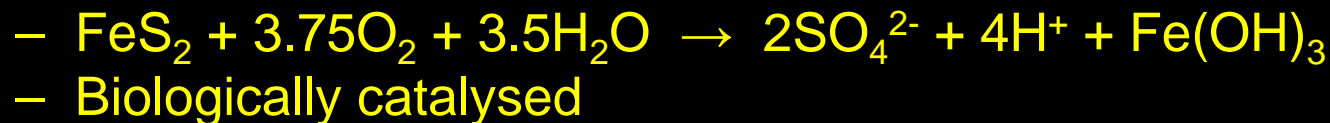


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 2. Rock geochemistry and acid base accounting data
 3. Turbidity data
4. Comparison to West Coast
5. Summary

1 Introduction – Mine Drainage Chemistry

- Pyrite oxidation



- Release of other components

- $\text{KAlSi}_3\text{O}_8 + 2\text{H}^+ + 6\text{H}_2\text{O} \rightarrow \text{K}^+ + 3\text{H}_4\text{SiO}_4(\text{aq}) + \text{Al}^{3+} + 2\text{OH}^-$
- Other sulphide minerals FeAsS, ZnS
- Trace elements also included as impurities in sulphides

Mine Drainage Chemistry

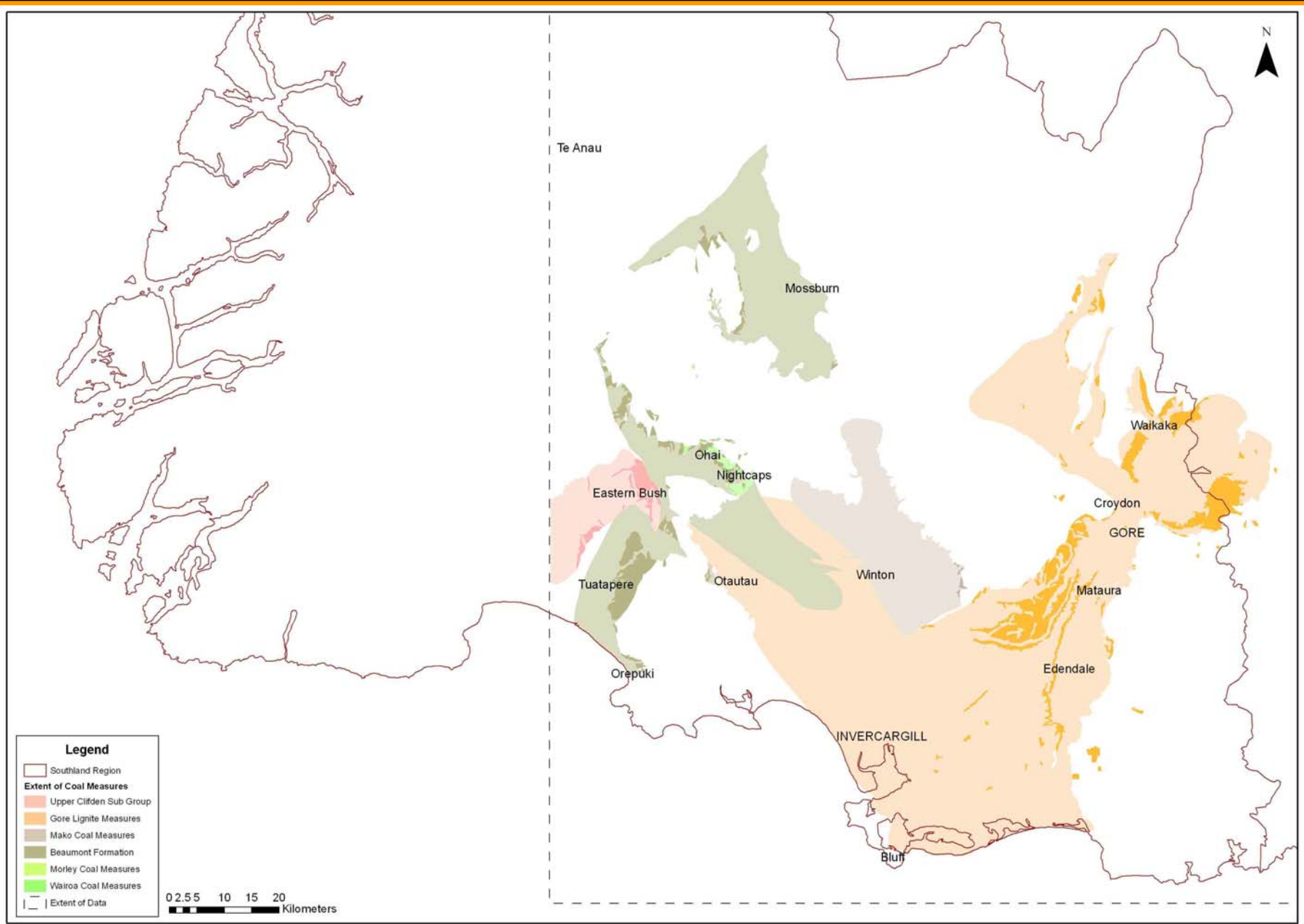
- Formation processes well understood
- Acidity and/or elevated trace elements are the main problems
- Chemistry is variable
- Can identify PAF rocks with reasonable certainty through acid base accounting
- Can also identify trace element rich rocks

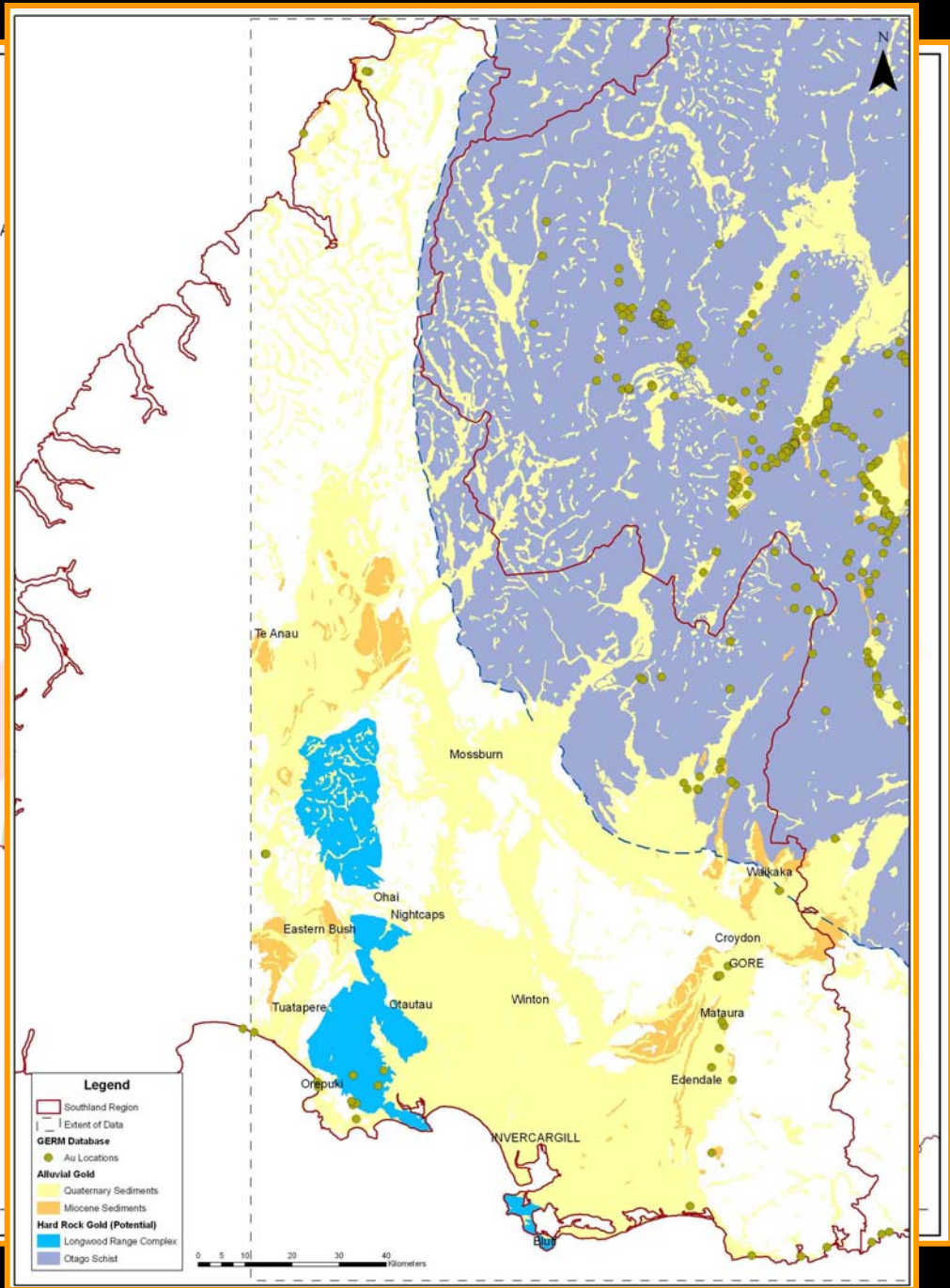
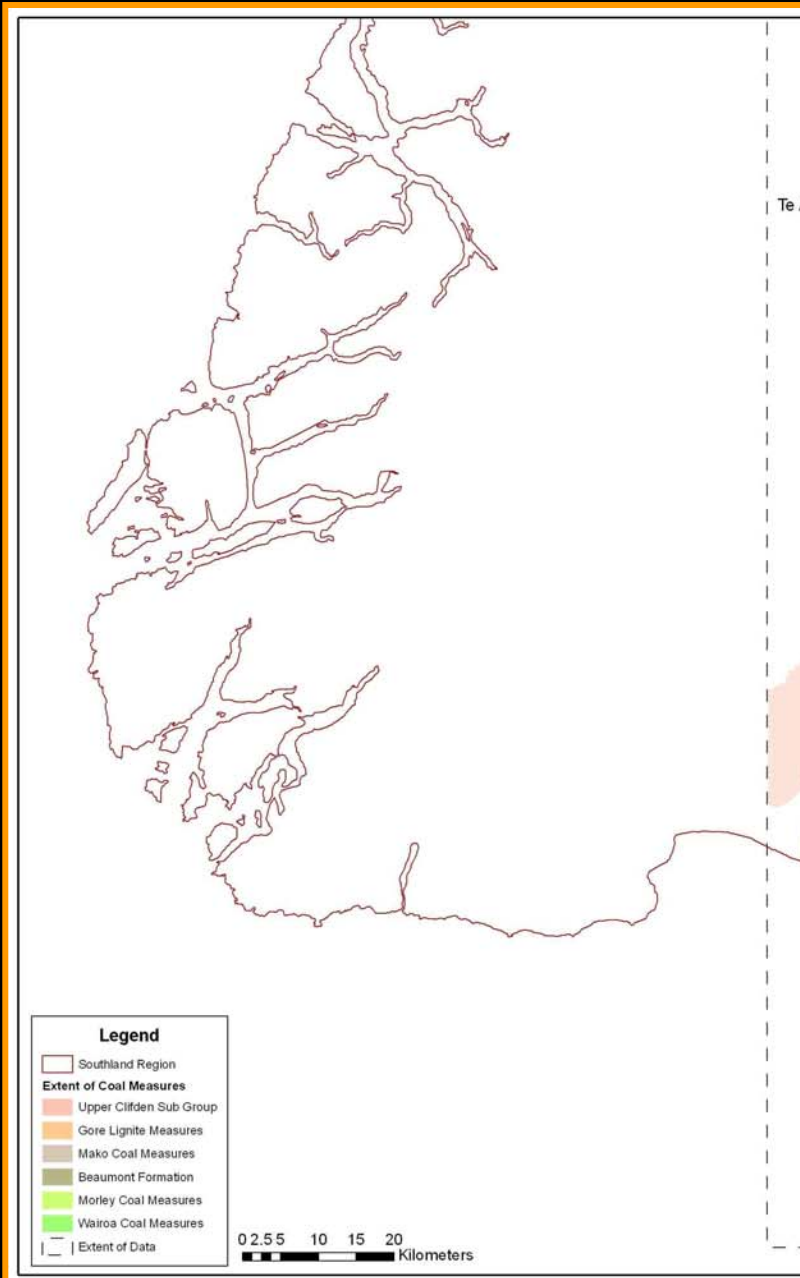
Data Compilation - Southland

- Geological and mining information
- DAME – Database for assessment of mine environments
 - Water Quality Data
 - Rock Geochemical Data
- Southland data contributors
 - Environment Southland
 - SENZ, Eastern Corp.
 - NIWA

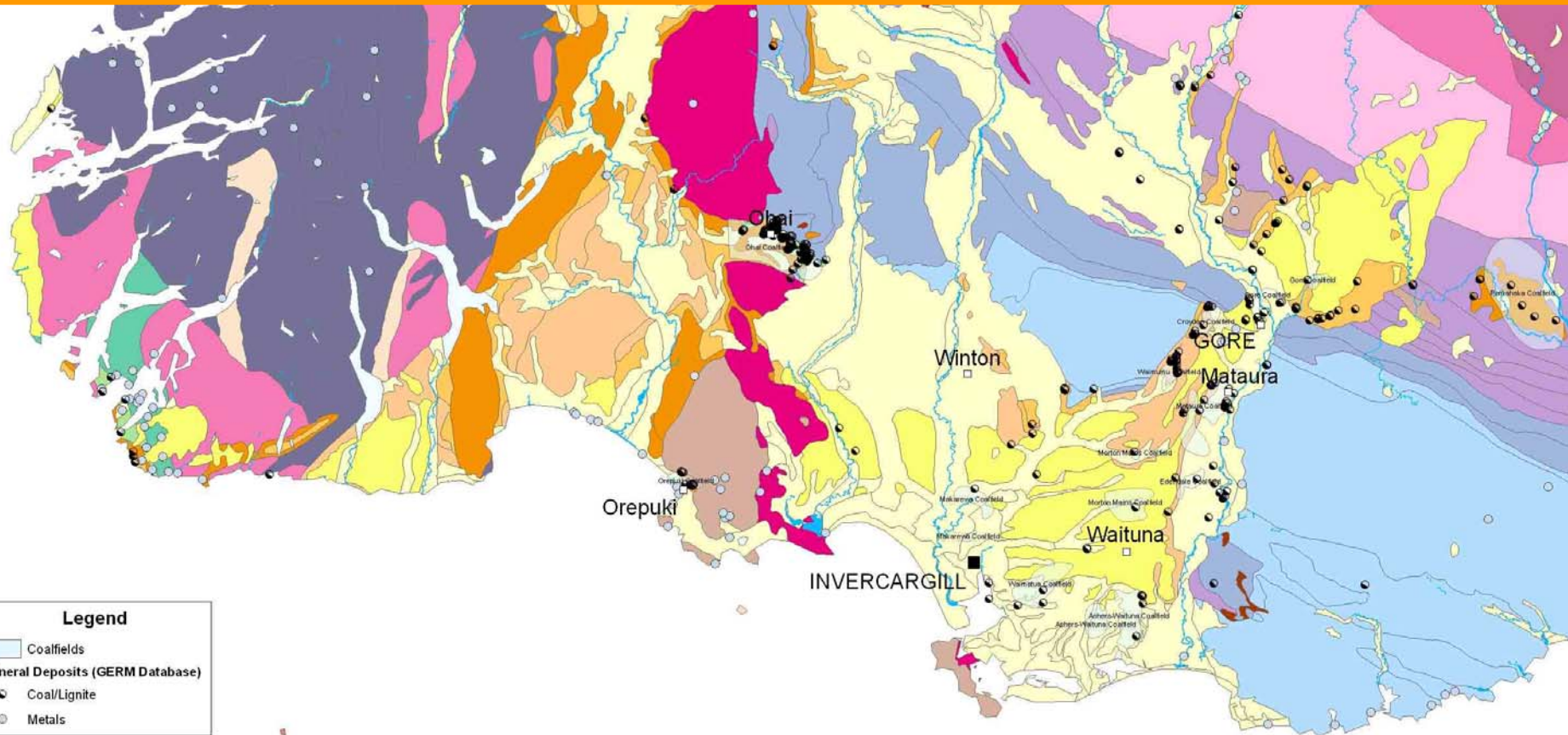
2 Coal and gold in Southland

- Sub-bituminous coal
- Lignite
- Hardrock Gold
- Alluvial Gold





Mine sites in southland





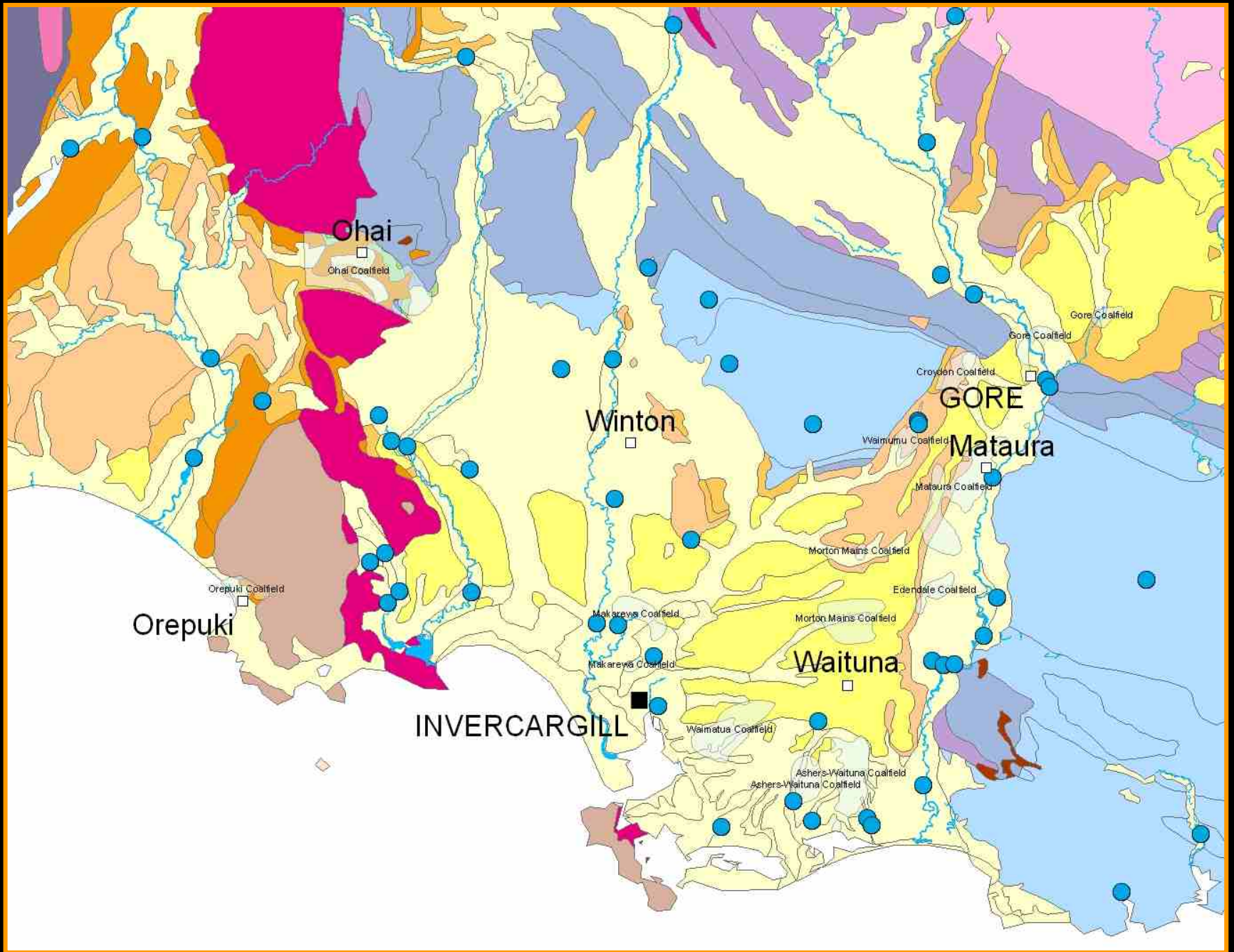
- Newvale Mine
- ~200 000tpa



- Curragh Mine
- 6Mtpa

Data Compilation ctd.

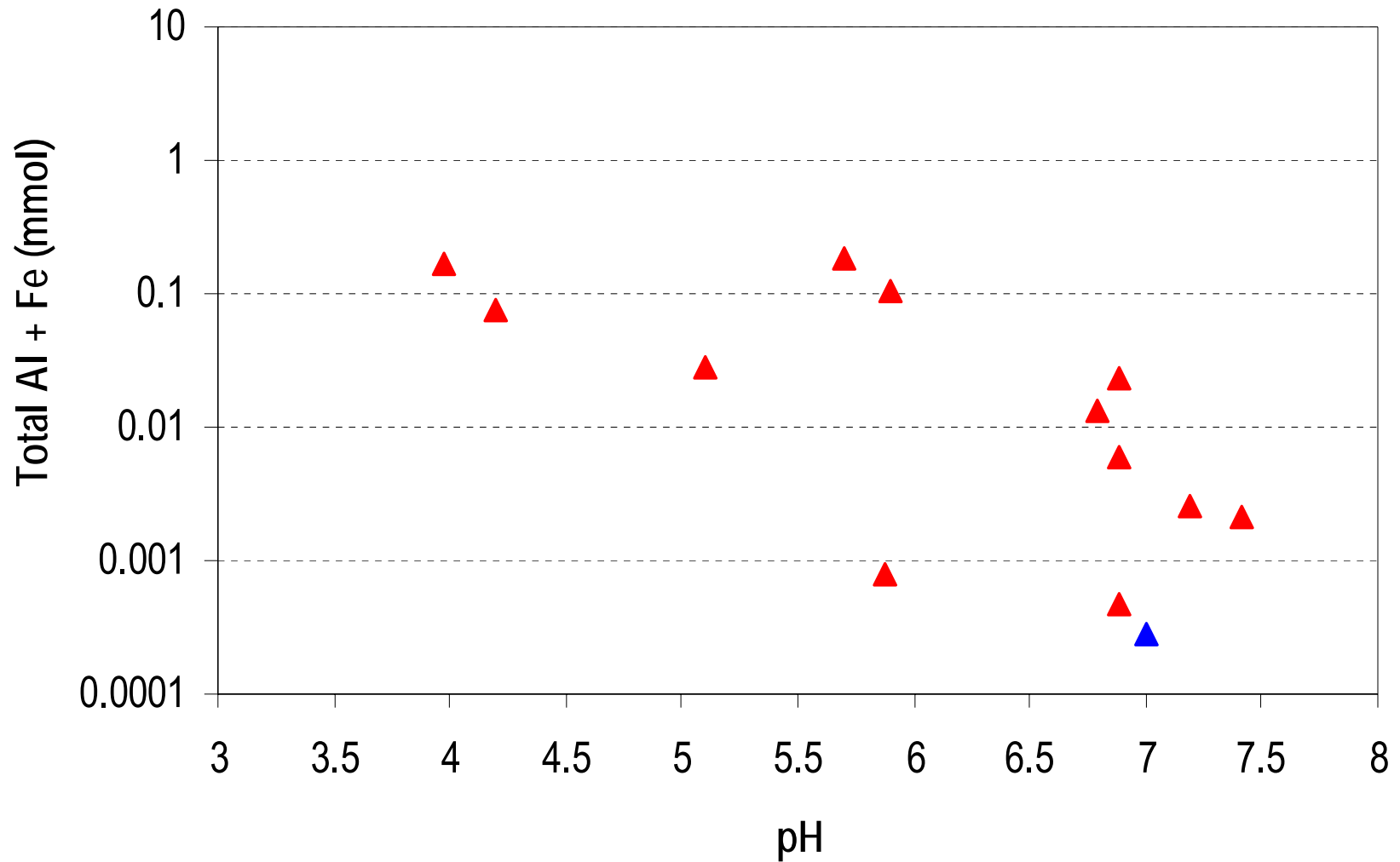
- Water quality data
- Mine drainage data
 - Newvale, Bell Brooke, Ohai
- Rock Geochemistry data



Data Compilation - Summary

- Little data available
 - AMD at Bell-Brook
 - Acid base accounting data only from Ohai
- Gaps identified
 - Few mine drainage or pit lake analyses
 - Acid base accounting data
 - Little understanding of distribution of Bell-Brook style AMD
 - No data on groundwater chemistry in lignite deposits

Data Acquisition - Mine Drainage Chemistry



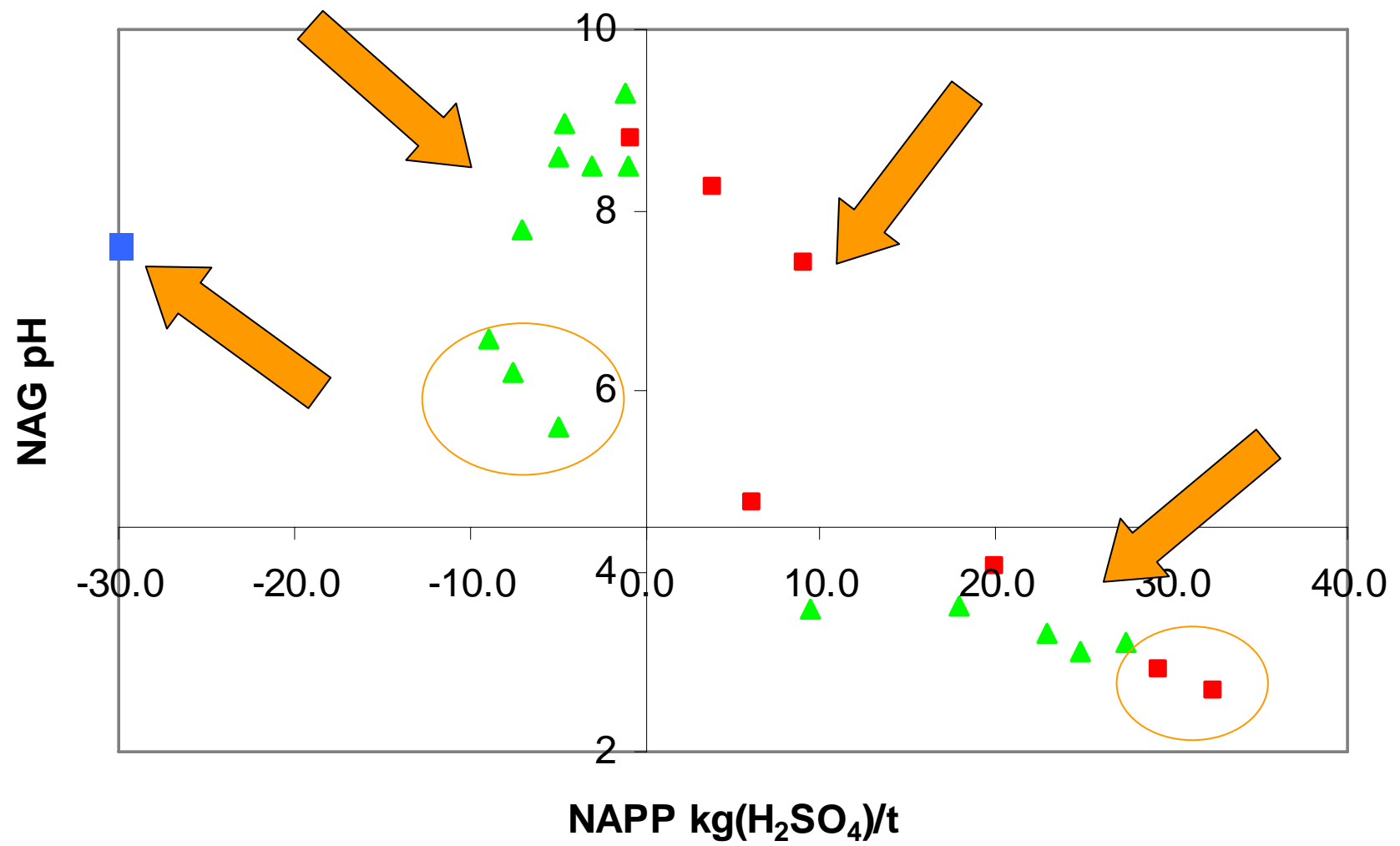
Acid Base Accounting Methods

- Maximum potential acidity (MPA)
 - Estimate total acid production from S content
- Acid neutralising capacity (ANC)
- Net acid producing potential (NAPP) = $MPA - ANC$
- Net acid generation
 - Oxidise sulphides and react neutralising components simultaneously

Gore Lignite Measures



Matura Acid base Accounting



MPA Data

- Sulphur can be present in several different oxidation states in rocks
 - Sulphide
 - Sulphur
 - Sulphate
 - Organic bound S
- Can conduct sulphide specific analyses
 - Chromium reducible sulphur
 - More expensive
 - Require a fresh sample

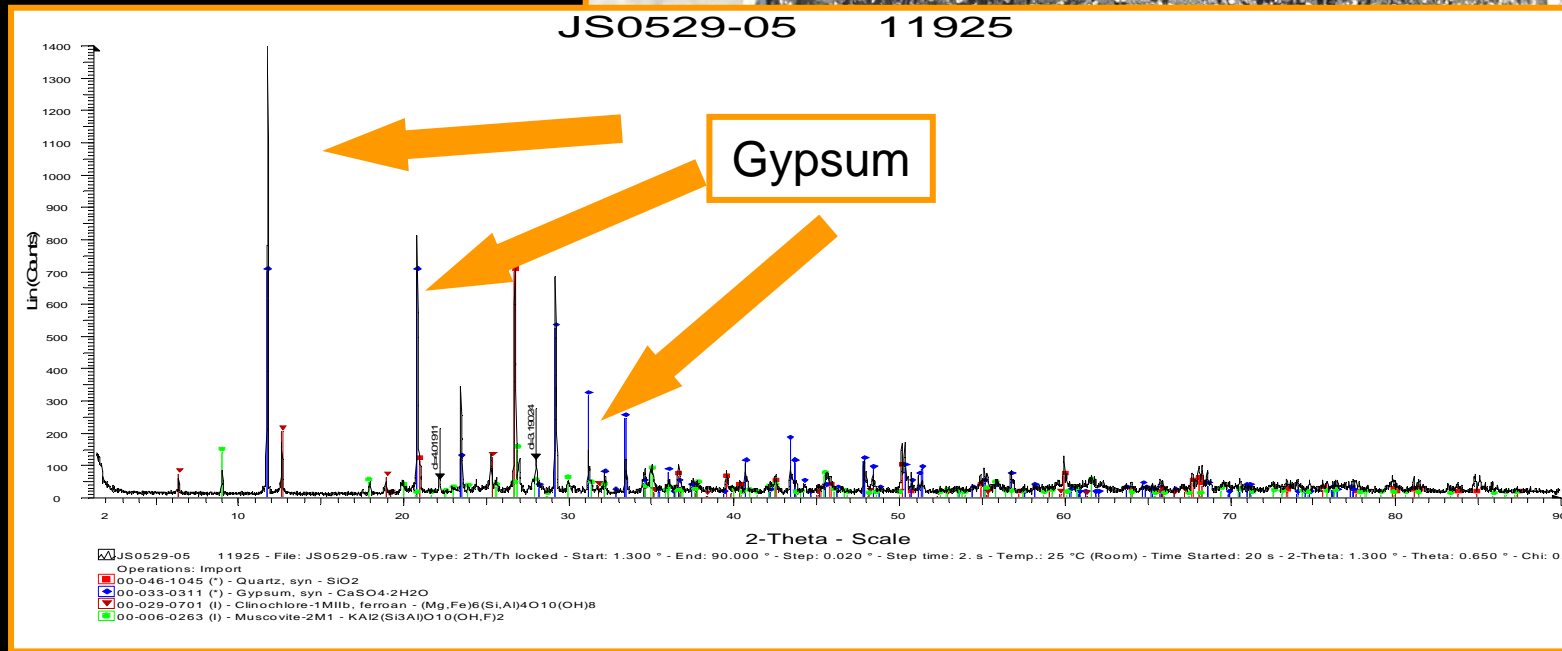
Chromium Reducible Sulphur

- Conducted chromium reducible sulphur (CRS) on several samples from Matura
- In general CRS about half total sulphur
However...

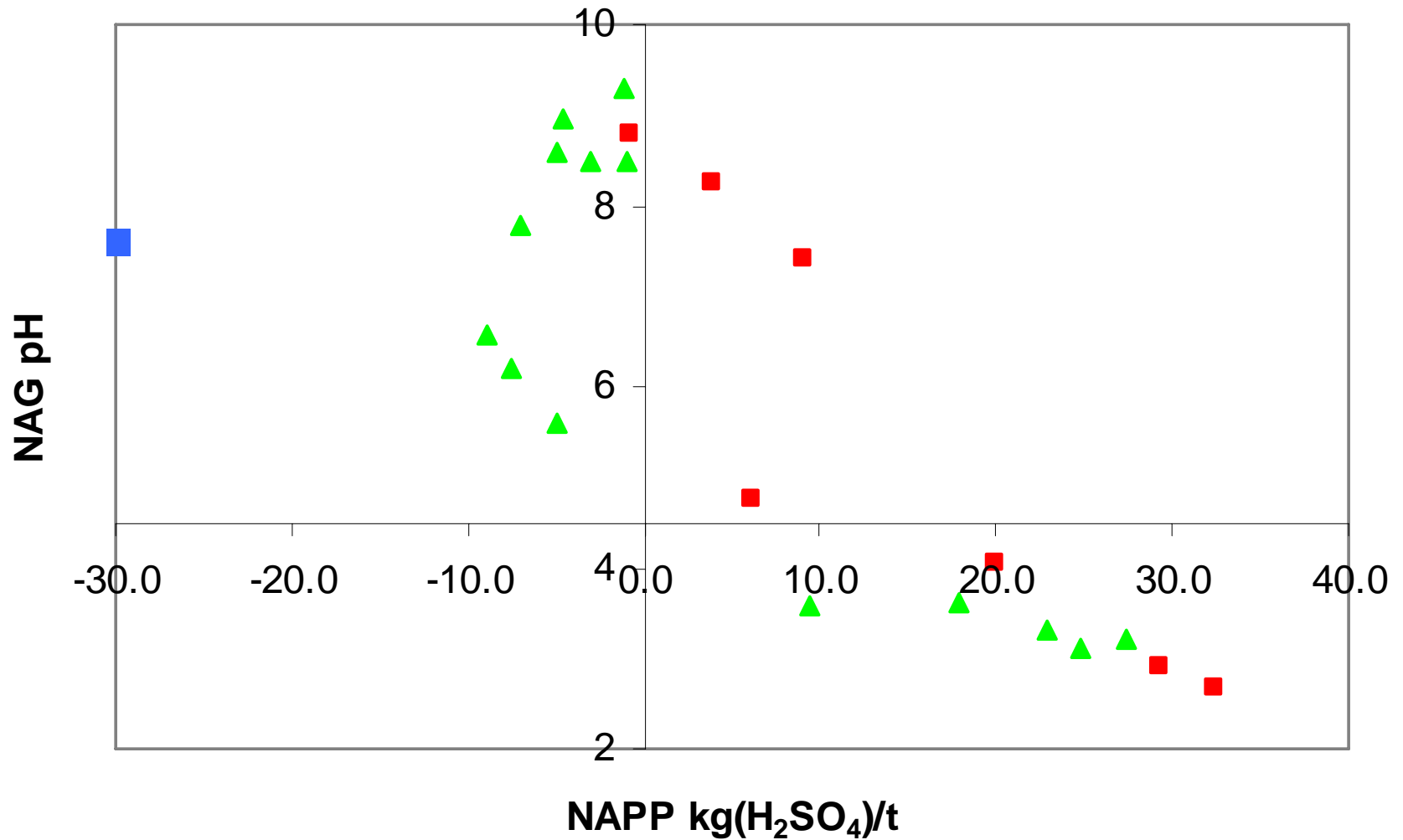


Chromium Reducible Sulphur

- Conducted chromium reducible sulphur (CRS) on several samples from Matura
- In general CRS is low
However...



Mataura Acid base Accounting

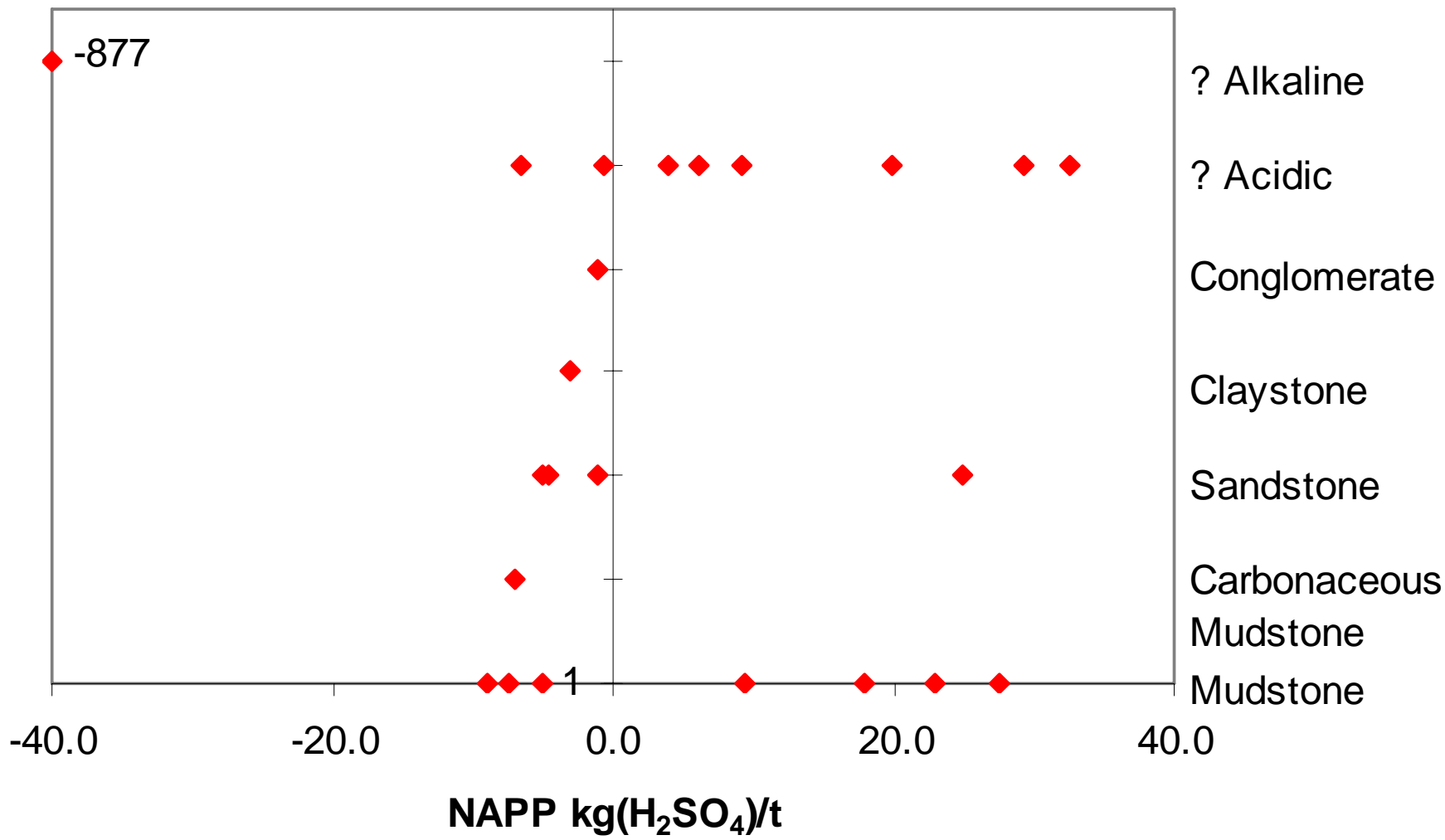


Net Acid Generation Data

- Uses a strong oxidising agent
 - H_2O_2 – not selective
- Organic material also reacts with H_2O_2
- Limited use especially in carbonaceous sediments
- Causes a false positive result

Net Acid Generation Data

- Example
- Samples from Croydon
 - MPA = 1 kg(H₂SO₄)/t NAG = 11 kg(H₂SO₄)/t
 - MPA = 9 kg(H₂SO₄)/t NAG = 34 kg(H₂SO₄)/t



Other Acid Base Accounting Data

- 7 representative samples from Nightcaps mine
 - NAF rocks
- 10 representative samples and 25 suspected PAF samples from Croydon
 - Representative samples NAF
 - Some suspected PAF samples highly acid producing
- 14 samples from gravels
 - All NAF
- 10-15 samples from Newvale Mine
 - Mostly NAF – one PAF

Other data acquired

- Piesometers samples from throughout Southland
 - PAH analyses
 - Trace element analyses
- Slight elevation of some naturally occurring PAHs
- No substantial elevation of trace elements
- Turbidity prediction

Turbidity at Southland Mines



- Newvale
 - Turbidity settles naturally
 - Days to month
- Ohai
 - Turbidity requires treatment
 - Little settling > 6months
-
- Nightcaps, Mataura

Summary of data acquired

- Gaps identified

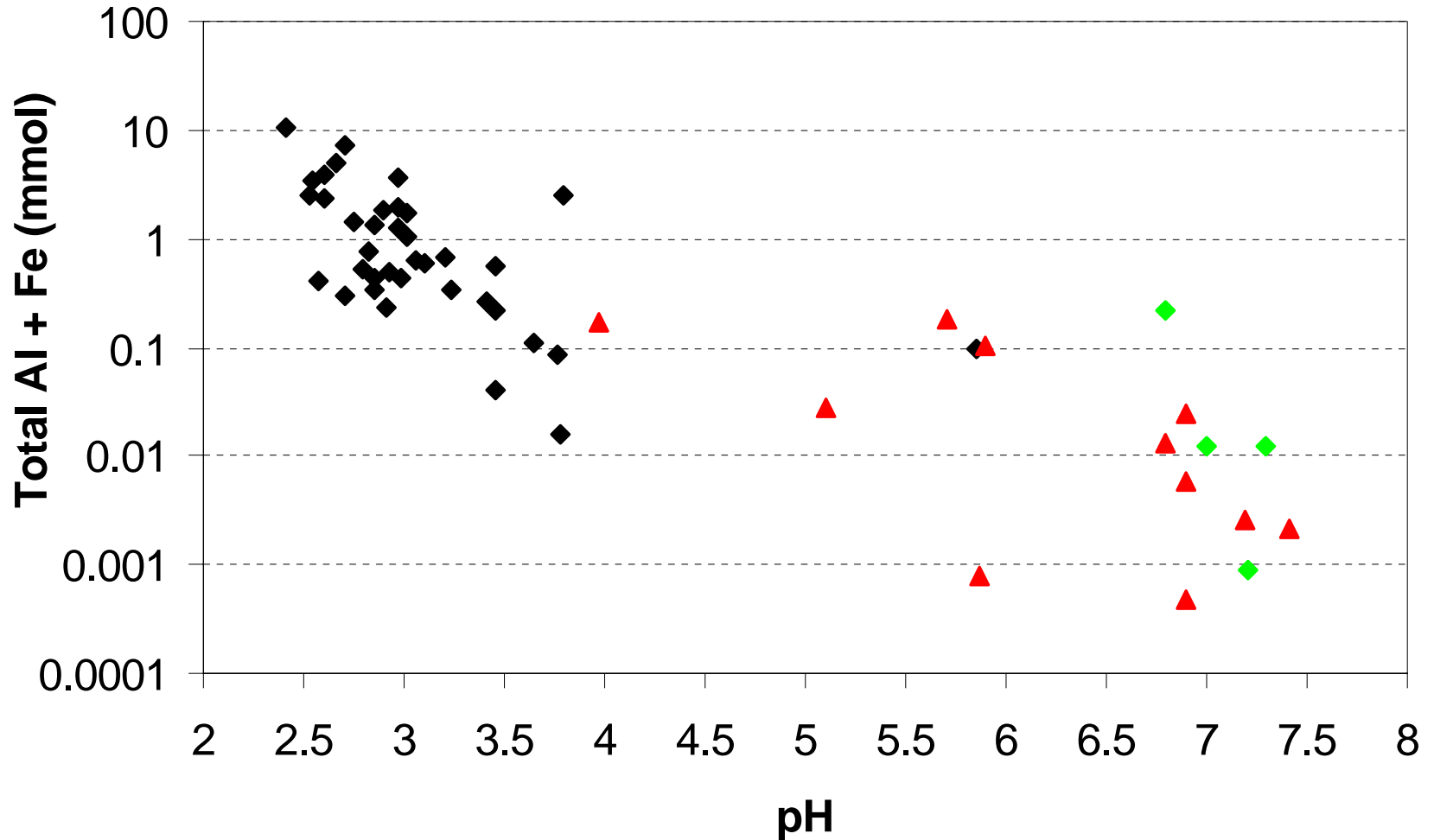
- ✓ • Few mine drainage or pit lake analyses

- ✓ • Acid base accounting data

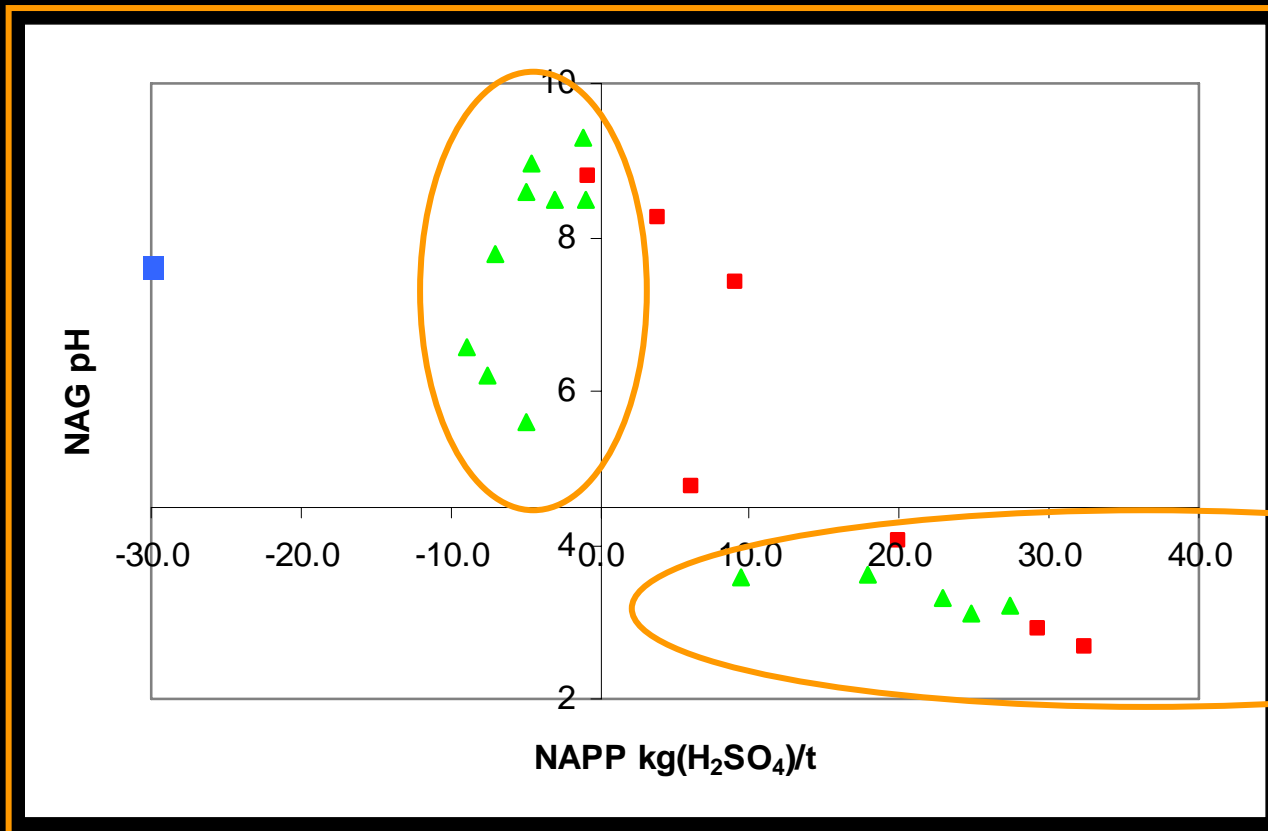
- ?✓ • Little understanding of distribution of Bell-Brook style AMD

- ✓ • No data on groundwater chemistry in lignite deposits

Comparison to West Coast – Mine Drainage Chemistry



Comparison to West Coast – Acid Base Accounting



Paparoa Coal Measures

Bruner Coal Measures

Concludsion

- There is currently only very localised acid mine drainage in Southland
- There is potential for AMD – there are some PAF rocks in the Gore Lignite Measures
- Any acid mine drainage issue is almost certain to be much more mild than the West Coast AMD
- We have an opportunity in Southland to be proactive rather than reactive and prevent mining related impact on aquatic ecosystems

