



International Association of Hydrogeologists

WESTERN AUSTRALIAN BRANCH

Monday 5 December 2005 Meeting

AGM & Students' night

Rochelle Irwin

**Trace element associations with minerals and precipitates in
acid-saline Wheatbelt drains**

Troy Cook

**Hydrogeochemistry of an acidifying aquifer of the southern
Wanneroo groundwater region, Perth**

Ricky van Dongen

**Paddock-scale mapping of the zone of influence of shallow
watertables and deep drains using remote sensing**

Sponsored by IAH

Rochelle Irwin

Drains are being constructed in the Wheatbelt region by farmers whose properties are increasingly becoming prone to ground-waterlogging. A geochemical risk assessment has been undertaken by the DoE's Engineering Evaluation Initiative, of which this research is part, as concern has been raised for possibly toxic concentrations of elements (major, trace and lanthanides) within the areas receiving the drain water. It was hypothesised that trace elements would be concentrated in the solid phase in a stable form, thereby reducing the toxicity of drain water. Therefore, trace and rare earth elements were studied both in the drain water and solid phase to establish the likelihood of toxicity. Minerals and precipitates were sampled from drains across the Wheatbelt. These were analysed using X-ray diffraction, scanning electron microscopy and transmission electron microscopy to determine mineralogy and qualitative chemical composition. The samples were also extracted sequentially and the extracts were analysed by inductively coupled mass spectrometry to obtain quantitative values for a wide range of elements. Groundwater was highly concentrated in Al and Fe in all areas with respect to freshwater averages. Precipitates identified include iron oxides (ferrihydrite, akaganeite, goethite), aluminium oxyhydroxide resembling pseudo boehmite, monosulfidic sediment and evaporites gypsum and halite. Indeed Al and Fe were concentrated in the solid, stable form of oxides within the drainage environment and trace elements associated with these minerals were highly variable in concentrations, but did appear to concentrate within the solid phase.

Troy Cook

Troy's PhD, a work in progress, is centered on the Hydrogeochemistry of an acidifying aquifer of the southern Wanneroo groundwater region, which contains lakes Gngangara, Jandabup and Mariginiup. Lake sediment oxidation due to surface water level decline has caused lake water pH to be as low as 2-3 in these lakes. This is due to drying of modern organic rich lake sediment, an Acid Sulphate Soil (ASS), and is contributing to the low groundwater pH in the areas down gradient of the lakes. Podzols (strongly cation depleted soils) in the areas to the east of the Southern Wanneroo Groundwater Area are also likely contributing to groundwater acidity. There is potential for substantial damage to both infrastructure (due to the acidity and iron levels) and the environment (due to biologically significant metals which have been released) from this groundwater acidity but more investigations are required to understand the potential impacts.

Ricky van Dongen

Water level changes that result from rising groundwater or deep drains that intercept the watertable may affect biological productivity across a significant zone of influence. Estimation of the zone of influence of salinity or deep drains at paddock-scale would assist in assessing the economic impacts of salinity and of drainage. Remote sensing was used to assess the spread of salinity over time at valley sites at Dumbleyung, Pithara and Beacon. In addition remote sensing was used to assess temporal and spatial changes in vegetation condition surrounding a deep drainage site at Narembeen.

The spatial and temporal changes in the area of saline land were assessed using Normalised Difference Vegetation Index (NDVI) derived from Landsat data acquired between 1987 and 2004. NDVI and soil electrical conductivity (ECah) measured with an EM38 at three of the four sites ($R^2 = 0.5$ to 0.7).

At Dumbleyung, Beacon and Pithara derived salinity maps showed that, from 1988 to 2003/4 the area of saline land increased by an average of 111 %. The 2003/4 salinity maps explained 87 to 93 % of variation in field ECah data and were comparable to salinity maps produced in 2000 by the Land Monitor Project. At Narembeen, between 1996 and 2003, spanning the period before and after the deep drain was installed, the mapped area of saline land declined by 11.2 %. Areas of possible remediation due to drainage were identified at the Narembeen site using the NDVI transects and a NDVI pre- and post drainage difference image.

VENUE	Celtic Club, 48 Ord Street, West Perth
DATE	Monday 5 December 2005
TIME	6-7pm (light refreshments from 5.30)
PARKING	Street parking or Thomas Street Car Park

ALL WELCOME

IAH Committee, WA Branch

Chair

Louise Stelfox
Department of Environment

louise.stelfox@environment.wa.gov.au

Vice-Chair

Colin Walker
Geo & Hydro Environmental Management P/L
ghem@bigpond.net.au

Treasurer/Secretary

Ron Colman
Department of Environment
ron.colman@environment.wa.gov.au

Meetings Secretaries

Gary R Brophy
URS Australia Pty Ltd
gary_brophy@urscorp.com

Anna Lach
Water Corporation WA
anna.lach@watercorporation.com.au

State Liaison

Philip Commander
Department of Environment
philip.commander@environment.wa.gov.au

Newsletter

Ryan Vogwill
Department of Environment
ryan.vogwill@environment.wa.gov.au

Web Page

Jan Vermaak
Golder Associated Pty Ltd
jvermaak@golder.com.au

IAH Survey

Bill Scott
School of Environmental Science
Division of Science and Engineering
Murdoch University
B.Scott@murdoch.edu.au