

## 13<sup>TH</sup> ANNUAL RSWA POSTGRADUATE SYMPOSIUM 2011

The 13<sup>th</sup> Annual Postgraduate Symposium, held on Saturday 17<sup>th</sup> September at the University of Western Australia, was a resounding success. More than 60 students, their colleagues, supervisors, RSWA members and councillors attended the event at which there were ten oral presentations and 10 poster presentations.. Dr Philip O'Brien, President RSWA, welcomed participants and stressed how valuable the RSWA Postgraduate Symposium is as an opportunity for postgraduates to present to fellow students and hone their presentation skills in a friendly, non-threatening environment, to get feedback on their research, and network with students from other disciplines. The presentations this year were outstanding, ranging from gravitational wave detectors to Rottnest's frogs, and generated lively discussions during the tea and lunch breaks and end of day drinks.

Once again Phil O'Brien presided over the BBQ and Lynne Milne and Jane Rosser organised the catering, assisted on the day by councillors Miira Gallegos, Kate Trinajstic, Kate Wright, Sandra Toby, Hugo Bekle and Chris Florides. The Society thanks the School of Earth and Environmental Science at UWA for sponsoring the venue. The 15<sup>th</sup> Annual Postgraduate Symposium will be held in September 2012 at Edith Cowan University.

The titles of the oral and poster presentations are listed below. The oral presentation abstracts are included in this issue of the Proceedings. The poster abstracts will be published in the November Proceedings. All abstracts and photos from the Symposium will shortly be on our new website.

### Oral Presentations

Martin Paesold (UWA and Curtin)	Molecular simulation of coupled mineral reactions
Nannapat Natchakunlasap (Curtin)	Investigation of palaeo-climate of south western Australia during the Holocene using a (high resolution) multi-proxies approach
Anais Pages (Curtin) different	Biomarkers of sulphate reducing bacteria from a variety of aged samples including a modern microbial mat
James Tweedley (Murdoch of	The biogeography and species compositions of the fish faunas estuaries on the south-western Australian coastline
Dan McDonald (ECU) Australia:	Household resilience to fuel price rises in Perth, Western A geographical perspective.
Maggie Triska (UWA)	Determining brush-tailed phascogale ( <i>Phascogale tapoatafa</i> ) presence in unmined jarrah forest in south-western Australia
Xiangling Fang (UWA)	Pathogenicity of <i>Fusarium oxysporum</i> on strawberry and the resistance of strawberry cultivars to this pathogen.
Desiree Moon (ECU)	The colonisation and subsequent dispersion of six introduced

Shari Gallop (UWA)	species avian Natural coastal structures provide storm protection but inhibit beach recovery
Julia Wilcox (Murdoch) of	Investigation of chytridiomycosis occurrence in the frog species Rottnest Island

## Molecular Simulation of Coupled Mineral Reactions

a,b,c

c

b

b,d

Martin K. Paesold

, Julian D. Gale , Alison Ord , Bruce E. Hobbs

<sup>a</sup>Department of Physics, Swiss Federal Institute of Technology Zurich, Rämistrasse 101, 8092 Zurich, Switzerland; <sup>b</sup>School of Earth and Environment, University of Western Australia, <sup>c</sup>Nanochemistry Research Institute, Department of Chemistry, Curtin University, <sup>d</sup>CSIRO Earth Science and Resource Engineering, PO Box 1130, Bentley, WA 6102

During exploration of ore deposits it is essential to study the basic processes involved in their formation. A better understanding of these processes could yield criteria for the size of ore bodies and provide better estimations of their ore grade. This talk will focus on the atomic scale of ore body formation and present recent approaches in the study of coupled mineral reactions by means of molecular simulations.

The physical theory that describes atomic processes is quantum mechanics, but for the systems relevant in this study a strictly quantum mechanical treatment is not feasible because thousands of atoms are involved. The treatment can be greatly simplified if we resort to force fields. A force field is an empirical model that approximates an atomic systems under certain conditions. We designed a force field that can describe electron transfer reactions of iron in water. Electron transfer is a crucial step in the formation of Hematite – a mineral that is the main source of iron today.

## Investigation of palaeo-climate of South Western Australia during the Holocene using a (High Resolution) multi-proxies approach

Nannapat (Grace) Natchakunlasap

*Environmental Inorganic Geochemistry Group, Dept of Applied Geology, Curtin University*

I have investigated changes of climate in the Perth area during the Holocene period (recent to 10,000 years) from lake sediments using 4 different approaches: lithology, geochemistry, diatoms and pollens. Sediments were classified using visual estimation and smear slide tests for particular intervals. Two cores from Tangletoe Swamp and Nowergup Lake were divided into litho-stratigraphical units using their sedimentary characteristics. Magnetic susceptibility was determined and a series of loss on ignition determinations were performed at different temperatures to determine water, organic matter and carbonate contents. Sediments from Nowergup Lake ranged from coarse sapropel to fine carbonaceous algal gyttja and were saturated with water, while Tangletoe Swamp sediments comprised grey nodular silty clays, organic silt and herbaceous peat. The physical and chemical properties determined in this study can indicate climate change from a terrestrial record (sediment core). Two major climatic periods have been recognised. The first is well recorded in core samples from Nowergup Lake extending from the late Pleistocene (~15,800 years BP) to late Holocene? (~4000 years BP) in age. An equivalent record is found at Tangletoe Swamp and extends from the early Holocene (~9,900 years BP) to approximately ~4,000 years BP. The sedimentary records indicate that  $\delta$ this period

was hot and dry with low accumulation rate of sediments. In addition, intensive evaporation with estimated temperature was over 40 °C is indicated for Tangletoe Swamp. It appears that the climate was significantly hotter and drier as one proceeds further inland in a north-eastward direction from the coast. A later climatic period is recognised in the sediments of Tangletoe Swamp beginning at ~3,900 years BP and somewhat later the sediment record at Nowergup Lake, (~3,390 years BP) extending to the present day. This later climatic period is characterised by a warm and wetter climate. Temperature dropped from the previous period during the early to middle of the Holocene. Accordingly, there was an increase of carbonate content and increased magnetic susceptibilities in the sediment record suggesting a higher rate of allochthonous sediment influx to the lake and the swamp. This conclusion is supported by pollen and diatom data. The pollen concentration continuously increases after the middle of the Holocene, indicating a rich *Eucalyptus*-*Melaleuca* plant community in the vicinity of Tangletoe Swamp at that time. Pollen of sedges is also common indicating a high water level during this period. Increased precipitation and a resulting rise in the regional watertable, with groundwater composition buffered by the Tamala Limestone, resulted in increased availability of fresh water. This is also evidenced by a decrease in the plants and diatoms that tolerate high salinity such as *Chenopodiaceae* and *Campylodiscus clypeus* and *Amphora coffeaeformis* respectively. Increase of epiphytic diatoms, attached to aquatic plants, indicates that Nowergup Lake was enriched by nutrients that promoted growth of these primary producers. Blooming of eutrophic taxa such as *Fragilaria* and *Synedra* diatoms in the uppermost section of the core from Nowergup Lake was likely caused by anthropogenically introduced fertilisers, after European settlement. Carbon isotope analysis has also provided further evidence of vegetation changes and thus climatic variation. Decrease of (organic) carbon:nitrogen ratio and increase of  $\delta^{13}\text{C}$  isotopic composition from Nowergup Lake indicates warming and increasingly wetter conditions from the middle of the Holocene to the present day. Sediments in Nowergup Lake appear to have originated and derived from algae or C3 vascular plants rather than C4 plants adapted to a hot and arid climate.

### **Biomarkers of sulfate reducing bacteria from a variety of different aged samples including a modern microbial mat**

Anais Pages<sup>1</sup>, Kliti Grice<sup>1</sup>, Robert Lockhart<sup>1</sup>, Alexander Holman<sup>1</sup>, Ines Melendez<sup>1</sup>, Martin Van Kranendonk<sup>2</sup>, Caroline Jaraula<sup>1</sup>

<sup>1</sup> Curtin University; <sup>2</sup> Geological Survey of Western Australia

Most biomarkers present in sediments occur in only trace concentrations, trapped in kerogen or may be highly functionalised especially in recent sedimentary deposits. Consequently, such biomarkers can be extremely difficult to chromatographically resolve and present considerable analytical challenges, especially for isotope studies. Innovative hydro (Hy) pyrolysis (Py) techniques are able to target or convert many of these compounds into free hydrocarbons more amenable to gas chromatography mass-spectrometry (GC-MS) and compound-specific isotope analysis (CSIA). HyPy has been applied to a modern layered smooth mat from Shark Bay, Western Australia. Saturate and aromatic fractions from different layers of the mat have been analysed by GC-MS and CSIA. After HyPy, an even-odd distribution of *n*-alkanes has been revealed as well as very long-chain *n*-alkanes up to *n*-C<sub>38</sub>. Stable carbon isotopic values of the *n*-alkanes indicated the presence of at least two bacterial communities. The short-chain *n*-alkanes were likely to be representative of a cyanobacteria community ( $\delta^{13}\text{C}_{\text{C15-C23}}$  -18 to -25 ‰VPDB) while the carbon isotopic values of the long-chain *n*-alkanes supported the presence of sulfate reducing bacteria ( $\delta^{13}\text{C}_{\text{C25-C33}}$  -30 to -34 ‰VPDB). Long-chain fatty acids have been previously reported in sulfate reducing bacteria. It is hypothesised that this distribution and isotopic character representing sulphate reducing bacteria consortia may be preserved in the rock record. This hypothesis has been tested in the following Australian rocks: a Devonian

carbonaceous concretion containing an exceptionally well preserved fossil invertebrate from the Canning Basin, Western Australia, a Paleoproterozoic sample (1.6 billion years old) from a lead-zinc ore deposit from the McArthur Basin, Northern Territories; and a Paleoproterozoic chert (2.3 billion years old) from the Pilbara, Western Australia. Biomarkers of these samples showed a strong predominance of long-chain *n*-alkanes, up to *n*-C<sub>38</sub> with an even-odd distribution of the *n*-alkanes. Stable carbon isotope values were highly depleted and were concordant with the values obtained in the modern mat for sulfate reducing bacteria. The general similarity in the *n*-alkane distributions of these samples point to a sulfate reducing bacteria consortia.

### **The biogeography and species compositions of the fish faunas of estuaries on the southwestern Australian coastline.**

James R. Tweedley, Fiona J. Valesini and Ian C.

*Potter Centre for Fish and Fisheries Research,*

*Murdoch University*

Approximately 50 estuaries occur along the 2,400 km coastline of south-western Australia, many of which have undergone profound changes as a result of anthropogenic effects. These estuaries differ markedly in their morphology and hydrology and may thus be classified as either permanently, seasonally or intermittently-open to the ocean or normally-closed. During the last thirty years, the fish faunas of the shallow, nearshore and deeper, offshore waters of 14 of these estuaries have been sampled using comparable sampling methods.

Analyses of the resultant data demonstrate that, in their nearshore waters, species and family richness are greatest in the permanently-open estuaries of the lower-west coast and least in the normally-closed estuaries of the eastern southern coast, with the reverse being true for density. The nearshore waters of permanently-open estuaries were dominated by a combination of marine species and estuarine species that are also represented by discrete populations in marine waters outside the estuary. In contrast, the corresponding waters in seasonally-open and normally-closed estuaries are dominated by estuarine-resident species that are only found in estuaries.

In deeper offshore waters, species and family richness was greater in the permanently and seasonally-open estuaries than in normally-closed estuaries. Catch rates were greatest in the eutrophic Wellstead and Peel-Harvey estuaries and least in the oligotrophic Broke Inlet. Marine estuarine-opportunists dominated the deeper faunas of permanently and seasonally-open estuaries, whereas this role was played by estuarine species in normally-closed estuaries. The use of nMDS ordination demonstrated that the compositions of nearshore and offshore waters change progressively southwards along the west coast and then eastwards along the south coast.

### **Household resilience to fuel price rises in Perth, Western Australia: A geographical perspective.**

Dan McDonald

*School of Communication and Arts, Edith Cowan University*

This research will examine the spatial distribution of the impact of increasing oil prices on urban households and suburbs in the Perth metropolitan region. Underlying social, economic and environmental factors will be considered in the identification of key processes and in the explanation of these spatial patterns. Political and economic indicators point to a future of high oil prices and increased volatility in the marketplace. The world authority on energy analysis and projections, the International Energy Agency (IEA), has declared that peak oil production

was reached in 2006 and future supply will be associated with higher and more volatile prices. Indeed, crude oil prices have risen almost 20% in the last 12 months. Given that the form of Australian cities has been greatly influenced by cheap, readily available fuel and associated high rates of private vehicle usage, there is potential for widespread disruption to Perth households as this situation changes.

This study will undertake a locational resilience assessment based on further development and refinement of existing models (e.g. VIPER, VAMPIRE), such as the inclusion of variables (e.g. public transport), changes to the weighting of variables and improvements to the spatial representation and mapping of results. Creation of the new 'Household Oil Price Resilience Index' (HOPRI) will provide a more accurate assessment tool for determining how adverse impacts from rising fuel costs are likely to be distributed across Perth and between different suburbs and households. Previous models have used socio-economic (e.g. mortgage stress) and car dependency variables to create indexes of vulnerability. In this study, modelling will be extended to include public transport connectivity data, as higher fuel prices are shown to lead to higher public transport use. The availability and connectivity of public transport networks provides a high degree of resilience to higher fuel prices.

Data will be obtained from the 2006 and 2011 census (Australian Bureau of Statistics), in particular the datasets on socio-economic status and vehicle ownership and usage. This information will be combined with the output of a public transport connectivity assessment tool, the 'Land Use & Public Transport Accessibility Index' (LUPTAI), to create an index that identifies areas of least resilience. ABS data will be taken at the highest spatial resolution available, the Collection District (CD), and linked to the locational connectivity data from the public transport model. These data will be processed using geographical information systems software, such as ARCGIS, to generate maps showing household resilience index scores for Perth under different scenarios related to the demand elasticities for public transport relative to fuel prices (DEPTP).

2006 and 2011 data will be compared to determine trends and patterns, using the theoretical frameworks of sustainability and social equity will be used in the interpretation of results. It is expected that areas with higher population densities and better integrated public transport systems will demonstrate higher resilience than outlying suburbs. Furthermore, suburbs on the urban fringe attract lower property prices and, as a consequence, residents from lower socio economic status. Due to this financial vulnerability and location related car dependence, these household rely upon public transport access to provide a degree of resilience to fuel price increases. This model will have applications in urban planning, transport planning, civil emergency response planning in the event of supply disruptions from accidents or natural disasters.

### **Determining brush-tailed phascogale (*Phascogale tapoatafa*) presence in unmined jarrah forest in south-western Australia**

Maggie Triska

*The School of Plant Biology, Ecosystem Restoration and Intervention Ecology Research Group., The University of Western Australia*

The jarrah (*Eucalyptus marginata*) forest in south-western Australia lies within one of the world's 20 biodiversity hotspots; however there is limited knowledge about the habitat requirements of much of its native fauna. Additionally, mining practices within the region have created a matrix of mature and seral forest. Within this landscape many native fauna are

displaced during mining and restoration and are additionally influenced by the successional state of the restoration. Fauna species with somewhat simplistic habitat requirements may return to restored forest within a few years, however, species that require more long-term features may take much more time to return, if they ever return. Brush-tailed phascogales (*Phascogale tapoatafa*, hereafter phascogales) are native, arboreal marsupials which require habitat features that take many years to develop; therefore their presence within the landscape may be highly affected. This is suggested by the fact that very few phascogale detections have occurred in the region. Thus, to gain habitat information on phascogales we used a non-invasive sampling technique, tracking tunnels, to survey unmined forest around two of Alcoa's minesites, Huntly and Willowdale. Tracking tunnel surveys were completed from April–August 2011 and resulted in 1 detection at Huntly and 0 detections at Willowdale. The low number of detections further supported that phascogales are rare and occur in low densities around the minesites and prohibited the possibility of detailed habitat analysis. Therefore, surveys in areas of the jarrah forest with higher phascogale density may be required to determine specific habitat associations and then applied to this region. Overall, additional research needs to be completed in order to assess the distribution of phascogales in the region and their potential success.

## **Pathogenicity of *Fusarium oxysporum* on strawberry and the resistance of strawberry cultivars to this pathogen.**

Xiangling Fang, Martin J. Barbetti

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Strawberry (*Fragaria x ananassa*) is a high-value export crop grown in Western Australia (WA).  
Devastating

outbreaks of crown and root diseases in WA have impacted severely on strawberry production.  
Our previous

work showed that *Fusarium oxysporum* was most frequently isolated from diseased crown and root tissues of strawberry, with an isolation frequently of 50% of all fungi and oomycetes obtained. For the first time, studies were undertaken to determine the pathogenicity of these *F. oxysporum* isolates on strawberry and the response of eight commercial strawberry cultivars. *F. oxysporum* severely affected root, crown and crown vascular tissue, resulting in the rapid wilting and death of strawberry plants, and the dry weight of the infected plants were reduced significantly compared with the healthy control plants. The cultivars tested varied in their response to *F. oxysporum*. Festival was the most resistant cultivar to *F. oxysporum*, with disease

scores for plant top, crown, root and vascular tissue all  $\leq 1$  and the smallest reduction in root length (1 cm). Camarosa, the most widely grown cultivar in WA, was the most susceptible cultivar to *F. oxysporum*, with disease scores for plant top, crown, root and vascular tissue all  $\geq 2.8$  and the largest reduction in root length (13 cm). This study demonstrates for the first time that *F. oxysporum* is the main pathogen causing crown and root diseases of strawberry in WA, and highlights the existence of varying levels of resistance in current commercial strawberry cultivars to *F. oxysporum*.

## **The colonisation and subsequent dispersion of six introduced avian species**

Desirée Moon

*School of Communication and Arts, Edith Cowan University*

Ecosystems within the southwest region of our state have been impacted significantly by invasive species. This includes successful avian invaders, which, due to their national iconic status, aesthetic values as pets, or by virtue of simply appearing innocuous, have been accepted as belonging in this region. This study examines the colonisation and subsequent dispersion of six introduced avian species in association to geographic features and anthropogenic factors pertaining to the southwest region. It seeks to identify spatial and temporal patterns of spread; investigate ways in which the ecology of the species, as well as their ability to adapt to urban landscapes, has assisted their arrival and retention.

## **Natural coastal structures provide storm protection but inhibit beach recovery**

Shari L. Gallop, Cyprien Bosserelle, Charitha Pattiaratchi and

Ian Eliot *The UWA Oceans Institute, The University of*

*Western Australia*

Coastal structures, whether natural or engineered, generate much debate about the mechanisms through which they affect beach behaviour. This research focuses on Yanchep Lagoon during a winter storm. Yanchep has a sandy beach perched on Quaternary limestone formations in south western Australia. The geometric form of the limestone is extremely variable along this 2 km long stretch of coast. It forms coastal structures similar to engineered works including a seawall and a low-crested intertidal-reef or shore-parallel breakwater. An intensive field-based approach was used to quantify the storm-response of three beach profiles with different local geological influences at Yanchep Lagoon including: (1) an *Exposed Profile* which was not directly fronted seaward by submerged limestone; (2) a *Reef Profile* near the end of a low-crested limestone reef and directly fronted seaward by submerged limestone; and (3) a *Bluff Profile* where the dry beach is perched on a limestone platform with a low bluff along its seaward margin. During the storm, wave period increased from 7 to 15 s. Significant wave height in the surf zone increased from 1 to 1.5 m and offshore from 1 to 6 m. The beach response had extreme spatial variation alongshore. The Exposed Profile suffered the most erosion. Sometimes the Bluff Profile recovered while the Reef Profile continued to erode. Overall the Reef Profile was the most stable during the storm. One month post-storm the Exposed Profile had more than recovered to its original state while the Bluff Profile had not. This indicates that while the bluff offers some



beach protection during storms, its presence also hinders the beach recovery. This extreme alongshore variability in beach profile behaviour, related to the geometry of the local coastal structures, indicates that the type of perched beach is a key consideration in determining storm response.

### **Are Rottnest's frogs infected with a fungus?** Julia Wilcox

*Murdoch University*

Amphibians worldwide are facing a decline in population. Contributing factors include habitat disturbance including pollution, cattle damage, fish introduction and habitat destruction such as logging and wetland degradation. However, a chytrid fungus known as *Batrachochytrid dendrobatidis* causes the biggest threat. My project will determine whether frog populations of three species on Rottnest Island are infected with the fungus. If spores are detected, I will map where the disease occurs on the island as well as how much of the islands frog populations are infected.



Presenters of oral papers at the 13th RSWA Postgraduate Symposium. From left to right : Martin Paesold, Nannapat Natchakunlasap, James Tweedley, Desireé Moon, Julia Wilcox, Shari Gallop, Xiangling Fang

## Poster Presentations

Alene Tawang (UWA)	Seminal plasma from good sperm freezer emus provides protection to sperm during cryopreservation.
Hazel Gaza (UWA)	In search for the <i>Arabidopsis</i> phosphate transceptor
James Tweedley (Murdoch)	Comparisons of the benthic macroinvertebrate faunas in seasonally-open oligotrophic and eutrophic microtidal estuaries as indicators of environmental degradation
Jessie Moniodis (UWA) in	Terpenoid diversity and biosynthesis of valuable essential oils
Tian Rui (Murdoch)	Australian sandalwood ( <i>Santalum spicatum</i> ) Characterisation of the regulatory circuit required for the acid induction of the adaptive acid tolerance response protein Ipa in <i>Sinorhizobium medicae</i> wsm419
Umar Farooq (UWA) cloacal	Velocity of Japanese quail spermatozoa increases when gland foam is added to semen
XiXi Li (UWA)	<i>Eremophila glabra</i> reduce methane production in continuous fermentation
Xingjiang Zhu (UWA)	Gravitational wave background in our Universe.
Leigh Sheppard (Curtin)	Animal-free skeletal muscle growth on a synthetic hydrogel scaffold
Siddhartha Verma (UWA) control	Roberts Linkage as a very low frequency suspension and element in 3 <sup>rd</sup> generation gravitational wave detectors.



Authors of poster presentations at the 13th annual RSWA Postgraduate Symposium.  
From left to right: Jessie Moniodis, Leigh Sheppard, Tina Rui, Alene Tawang, James  
Tweedley, Hazel Gaza, XiXi Li



kngjiang Zhu and Lily Huang  
Natchakunlasap

Nannapat (Grace)

explaining her research to  
Miira Gallegos during the lunch  
break



**Dr Phil O'Brien, MINA  
break**



**Discussion around posters during the lunch**

**President  
addressing the  
symposium**

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