

Summary Reports from the Projects

**supported by the South Africa - Norway Programme on
Research Cooperation, Phase II 2006 -2011**

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Preface

This document is merely intended to give a first and cursory overview of the principal achievements of the projects supported by the second phase of the South Africa – Norway Programme on Research Cooperation. It is based on the final reports received by the end of 2010 and early 2011. The intention has been to present the results from the projects to a non-specialist audience in a comparable format, but that calls for a few explanations and words of caution:

All the reports are divided into five parts:

- a) A fact box with the details about the project, including institutions, PIs and expenditures.
- b) The “Original project summary”, which is the summary of the project proposal originally submitted and approved for funding
- c) A “Summary of main results”, mostly taken from the “Popular Science” report all projects were required to submit as part of their final reports
- d) A list of “main publications” emanating from the project
- e) A list of students attached to the project who have been awarded degrees in the project period¹.

There has, however, been some variation on how the different projects have chosen to report their findings, despite the standardised forms they were required to use. In some cases, the “popular science reports” have not addressed the results in a satisfactory manner and we have felt the need to extract information from the main results report, which are often very technical and too lengthy to be published in their entirety in this report. Thus some of the summaries of main results in this report are actually edited and abridged versions of the results reports. We apologise for any injustice we may have caused to some of the project reports in the editing process.

When it comes to the lists of “Main publications”, there have also been considerable differences in how the projects have been reporting. We have chosen to include only articles in peer-reviewed journals for the most part, as well as books. The length of the publication lists vary considerably from project to project. Sometimes publications not directly emanating from the project were included in the single final reports, thus giving a somewhat misleading impression of the “productivity” of each project. As a consequence, we have in some cases occasionally deliberately left out some of the reported publications, again causing some probable injustices to the projects when editing the publication lists.

Some additional points that may be kept in mind when comparing the publication lists:

- some projects supported under Phase II were also funded during the first phase (2002-2006) of the Programme and would naturally be in the position of having published more than those that started only in 2007;
- some projects have relied almost entirely on the modest funding received by the Programme, whereas in other cases the Programme has merely provided additional funding to already established major research initiatives where most of the funding has come from other sources;
- because of the nature of their research, natural scientists tend to be more prolific in publishing than researchers in the social sciences and the humanities. Publications in the natural sciences also have a higher frequency of multiple co-authorship.

Last, but not the least, it must be remembered that publishing research results is a very time-consuming process, especially when going through the quality assurance of a peer review. In most research projects, the bulk of publications appear one to two years after the research results have been obtained. As the final reports from the projects have been prepared just after the formal termination of the project, before the bulk of scientific articles could be submitted (let alone accepted!) for publication, it is expected that many more publications than the ones listed here will eventually emanate from the research. We already know for a fact that quite a few publications have come out in prestigious journals since the submission of the final reports, including at least one more in *Science*.

The publication of books, especially monographs, often the preferred means of scientific dissemination of researchers in the humanities and social sciences, can have an even longer time delay, often several years after the research as actually taken place,

¹ The listed students did not necessarily receive full scholarships from the respective projects, but benefited from participation in research activities, field work, exchanges, travel grants, etc.

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Assessment of current and future emissions of mercury from anthropogenic sources in South Africa

Responsible University/Institution, Norway:

Norsk institutt for luftforskning (NILU)

Principal Investigator, Norway:

Pacyna, Jozef M. Professor

Project no: 179784/S50

Financed by RCN (in NOK):

1.4.2007-30.6.2010

2007: **75,000** 2008: **75,000** 2009: **75,000**

Responsible University/Institution, South Africa:

CSIR Water Recourses

Principal Investigator, South Africa:

Leaner, Joy Dr.

Financed by NRF (in ZAR):

2007: **29, 006** 2008: **70, 470** 2009: **113, 489** 2010: **43, 471**

Original project summary

Mercury is one of the most important contaminants emitted to the atmosphere due to its toxic effects on the environment and human health, as well as its role in the chemistry of the atmosphere. Although substantial information has been collected on environmental effects of mercury and its behaviour in the environment much less data is available on atmospheric emissions of the element. Information on emissions is needed for various policy and modeling purposes. This information is very limited for sources and emissions in South Africa. The main goal of the proposed project is to provide a thorough assessment of current and future emissions of Hg to the air, water and land from anthropogenic sources in South Africa. An assessment of emissions from natural sources will also be made.

Summary of main results

The project started with an inventory of mercury sources was established for South Africa for the years 2000 and 2004. This involved the collection of information on the mercury content in raw materials, such as various fuel types and ores, with analytical measurement of Hg content in these ores, where necessary. In this context, one of the major highlights was the information received on the mercury content of South Africa's coal that is combusted at all the coal-fired power

stations in South Africa. This information was received from South Africa's major electricity supplier, and was used to draft and submit a chapter on mercury emissions in South Africa to UNEP Chemicals as part of a larger global mercury assessment. This was the first time that such information appear in the published literature regarding mercury in South African coal (see Leaner et al., section 9(a)). Furthermore, anthropogenic emissions inventory was expanded and updated to cover all the years from 2000 to 2006 in order to establish the trends. This phase included for the first time a combination of emissions into the atmosphere and to land (in form of solid waste) for different anthropogenic point sources.

Three scenarios for future emissions of Hg in 2020 have been prepared for South Africa, other African countries, and globally. They include the status quo (SQ) scenario that assumes no major development of currently available technology for Hg emission reductions in the period from 2005 to 2020, the extended emission control (EXEC) scenario with emission control devices currently used in the U.S. and the European Union, to be available for all countries in 2020, and the maximum feasible technological reduction (MFTR) scenario with the most effective solutions for the Hg emission reduction. These scenario estimates were published recently in the UNEP technical report

Main publication

Masekoameng, K. E. et al.

“Trends in Anthropogenic Mercury Emissions in South Africa during 2000 to 2006” *Atmospheric Environment*: 42(29):6620-6626

Dabrowski, J. M et al.

“Anthropogenic mercury emissions in South Africa: Coal combustion in power plants”, *Atmospheric Environment*: In print

Learner, J. J. et al.

Chapter 5: “Mercury Emissions from Point Sources in South Africa”, in *Mercury Fate and Transport in the Global Atmosphere: Measurements, Models and Policy Implications*. Springer. ISBN: 978-0-387-93957

LeanerJ.J. et al.

“Assessing mercury pollution and risks in South Africa: the South African Mercury Assessment Programme”, *Science of the Total Environment*: Submitted

Pacyna, J. M. et al.

2010 “Global emission mercury to the atmosphere from anthropogenic sources in 2005 and projections to 2020”, *Atmospheric Environment*: in press/ 2010

Pacyna, J. M. et al.

2010 *UNEP Report on Sources of Mercury to the Atmosphere*, Report submitted to UNEP

Assessment of estuary dependency and management of two important fishery species

Responsible University/Institution, Norway:

NINA (The Norwegian Institute for Nature Research)

Principal investigator, Norway:

Næsje, Tor F. Seniorforsker

Prosjektnr: 179811/S50

Financed by RCN (in NOK):

1.4.2007-30.9.2010

2007: **165,000** 2008: **260,000** 2009: **382,000** 2010: **140,000**

Responsible University/Institution, South Africa:

SAIAB (South African Institute of Aquatic Biodiversity)

Principal Investigator, South Africa:

Cowley Paul D., Dr

Financed by NRF (in ZAR):

2007: - 2008: **790, 600** 2009: **187,000** 2010: **426,740**

Original project summary

The dependency on critical habitats, such as estuaries, represents a bottleneck in the life-history of many exploited fishery species. The proposed project aims to assess the management implications of estuarine dependency in two important South African coastal fishery species, spotted grunter (*Pomadasys commersonnii*) and dusky kob (*Argyrosomus japonicus*).

The poor stock status of both species has been ascribed, in part, to the overexploitation of juveniles during their obligatory dependence on estuarine habitats. A rational management plan for these species cannot be developed without explicit information on their movement patterns and ontogenetic use of estuaries. Despite heavy exploitation of juveniles within estuaries, the same stocks also support coastal and marine fisheries. Therefore, successful management for these species relies on knowledge of their dispersal characteristics, migrations between estuaries and the sea, and the possible movements between neighbouring, nearby and/or other estuaries.

This study will assess ontogenetic changes in habitat use and the movement patterns of individuals between their natal estuary, other estuaries and coastal areas, using otolith microchemistry and acoustic telemetry methods. The results will provide improved knowledge on two of South Africa's most data-deficient fisheries, namely estuarine and subsistence fisheries, and be used to (i) evaluate the role of single estuaries in the production and export of juveniles to coastal

fisheries, (ii) evaluate the role of protected areas as a management option to assist with restoring spawner stock biomass levels, (iii) develop an appropriate management procedure to ensure sustainability, and (iv) form the scientific basis for capacity building and education of students.

The project promotes capacity building, equity redress and research excellence through collaboration during fieldwork and publication of project results.

Summary of main results

This project adopted a multi-faceted approach, using innovative techniques such as acoustic telemetry and otolith microchemistry to assess estuarine-dependency and management needs of three important fishery species, namely dusky kob, spotted grunter and white steenbraas. The telemetry aspect of this study focuses on the Sundays Estuary, its coastal embayment (Algoa Bay), and eight adjacent estuaries spanning approximately 300 km of coastline within the Eastern Cape Province of South Africa. A total of 49 data-logging receivers (VR2s) have been deployed on fixed moorings to determine estuarine dependency and the extent, timing and durations of movements between the estuarine and marine environments, and between neighbouring estuaries. Altogether 98 dusky kob, 43 spotted grunter and 58 white steenbraas have been tagged with acoustic transmitters in both estuarine and marine environments within the study area.

Results from the telemetry component of the project, with the purpose of understanding of estuarine dependency, multiple habitat use and habitat connectivity of the studied species, have provided insights into the value of estuarine nursery habitats and the feasibility of alternative management options that may ultimately contribute towards the development of sustainable management strategies for dusky kob, spotted grunter and white steenbras. This study has provided a platform for the management of these and other important estuarine-dependent fishery species. The multiple element chemical composition of otoliths is used to identify estuary-specific signatures and micro-chemical analysis on

otoliths, which will ultimately ascertain whether these species make use of single or multiple estuaries during their life. Otoliths from early juvenile fish from estuaries and larger fish from the sea were collected to determine their estuarine origin (natal estuary), and to ascertain if they used single or multiple estuaries throughout their lives. A new, state-of-the-art otolith micro-chemistry clean room was built at SAIAB in South Africa, which is used to prepare the otoliths before they are analysed in France. Data from this method has shown very promising to meet the objectives, and are presently under compilation and will be published in A. Childs PhD thesis in 2011.

Main publications

Childs, A-R., et al.

2008. "Do environmental factors influence the movement of an estuarine fish? A case study using acoustic telemetry", *Estuarine, Coastal and Shelf Science*. 78: 227-236

Childs, A-R., et al.

2008 "Estuarine residency and movement patterns of spotted grunter *Pomadasys commersonii*, in a South African estuary using acoustic telemetry", *African Journal of Marine Science*, 30 (1): 123-132.

Cowley, P.D., et al.

2008 "Estuarine habitat use in juvenile dusky kob *Argyrosomus japonicus* (Sciaenidae), with implications for management", *African Journal of Marine Science* 30 (2): 247-253.

Kerwath, S.E., et al.

2009 "Crossing invisible boundaries: can a marine protected area protect a mobile species?", *Conservation Biology* 23 (3): 653-661.

Thorstad, E.B., et al.

2009 "Size matters: Long-term effects of surgical implantation of telemetry transmitters in a predatory marine fish species (*Pomatomus saltatrix*)", *Marine and Freshwater Research* 60: 183-186

Hedger, R.D., et al.

2010 "Residency and migratory behaviour by adult *Pomatomus saltatrix* in a South African coastal embayment", *Estuarine, Coastal and Shelf Science*. 89: 12-20.

Childs, A.R., Næsje, T.F. and P.D. Cowley

(in press) "Long-term effects of different sized surgically implanted acoustic transmitters on the sciaenid *Argyrosomus japonicus*: breaking the 2% tag-to-body mass rule", *Marine and Freshwater Research*

Bennett, R.H. et al.

(in press) "First assessment of estuarine area use and home range of juvenile white steenbras, *Lithognathus lithognathus*", *African Journal of Zoology*

Degrees awarded to students attached to the project

Alusha Hitula (black female)	BSc (hons)	Rhodes University
Amber Childs (white female)	MSc (<i>cum laude</i>)	Rhodes University
Bronwyn O'Connell (white female)	MSc (<i>cum laude</i>)	Rhodes University

Gender in the Deliberative Public Sphere

Responsible University/Institution, Norway :

Handelshøyskolen BI

Principal Investigator, Norway :

Lippe, Berit von der Førsteamanuensis

Project no: 179814/S50

Financed by RCN (in NOK):

1.5.2007-31.12.2009 31.1.2010

2007: **39,620** 2008: **43,582** 2009: **45, 385** og 2010: **22, 693**

Responsible University/Institution, South Africa:

University of Cape Town

Principal Investigator, South Africa:

Salazar, Philippe-Joseph Dist. Prof.

Financed by NRF (in ZAR):

2007: **96, 721** 2008: **86, 362** 2009: **177, 432** 2010: **59, 451**

Original project summary

The question of the gender in relation to rhetoric studies understood as the discipline tasked with studying public argumentation and popular deliberative practices that are at the heart of a social and liberal democracy, has undergone radical developments in the past twenty years. It has led to a diversification of rhetoric theory and practice concerning democracy and deliberation, and, in keeping with Third Wave Feminism, has made rhetoric studies a field of excellence to re-examine gender-in-politics.

South Africa's consolidated democracy stands firmly by its constitutional principle of non-discrimination on the basis of gender as well as a sustained policy of gender redress and progress (if 52% percent of South Africans are women, 29% are elected town councillors and 18% are mayors, while their ratio in Parliament is one of the highest among democratic states). South Africa offers a field of enquiry on the rhetoric of gender on a new and challenging scale, unknown before in the South, while Norway provides a touchstone or reference for achieving gender parity.

Summary of main results

Within the rhetorical tradition, the focus is mainly on who is seen and what is read or heard. Most often it seems as the speaker of interest is the one who decides when it is time to talk and time to be silent. It is thus mainly about successful and not successful rhetoric from the perspective of the powerful. The study has raised the question: What happens when women enter power positions, positions

traditionally occupied by men? To some extent and in some positions, the gender does not seem to play any role. Women behave and talk as men?

The study has shown how feminist rhetoric is a vague concept and is understood differently by different scholars and in different cultures. It has made manifest that those scholars within feminist rhetorical studies who have sought to transform the rhetorical tradition from what is seen as upper-class, agonistic, public, and male into regendered, inclusionary, dialogic and collaborative rhetoric, does not hold.

In the study the notion of rhetorics of silence has been used to challenge the dichotomous perspectives that assert the binaries of male-agonistic/female-dialogic as well as gender blind or so-called gender neutral rhetoric. It is also suggested that at the latent and ideological level, and particular in war narratives and deliberation on security issues, the perspective might imply embedded masculinism; a masculinism from above devoid of any awareness of gender, class, ethnicity or race. The study has also shown how concepts, such as gender equality, allow for multiple conflicting interpretations, and how space is created for rhetoric, including empty declarations in public deliberation and large areas of silences. This is even more so when it comes to the rhetoric of white women speaking about and on behalf of brown women?

Finally, the many differences between feminism(s) both within Africa and within South-Africa, are brought forth, mainly by phd student Ruvimbo Goredema (University of

Cape Town). White women in Africa have contributed to the debate in their own way, and although their arguments have been acknowledged, they have been received and interpreted in a singular fashion ? they are simply regarded as a reinforcement of mainstream White Western feminism. One major challenge for African feminists, is

maintaining a position somewhere between their African-ness and white feminism. It is also discussed how identifying oneself as a feminist automatically links African feminists to white feminist ideology. How this is reflected in South-African mass media, though is not studied or discussed so far.

Main publications

Von der Lipper, B.

2007 "Metaforer og metamorfose i økonomisk retorikk", *Retorikk, samtid og samfunn* (Forlag 1/2007)

Von der Lipper, B.

2007 "Taushetens kjønnete retorikk i fortellinger om krig", *Materialisten* 3- 2007: 5-30

Von der Lipper, B.

2008 "Medier – makt og motmakt. Telenor håndtering av u-etiske praksiser i Bangladesh, *Materialisten*, 2/3-08: 57-86

Von der Lipper, B.

2009 "Retoriske blikk på økonomiske fortellinger", *Materialisten*, 1/2-09: 19-45

Von der Lipper, B.

2009 "Kairos, Makt og Motmakt", in *Retorikk, etikk og næringsliv* (Odd Nordhaug og H-I. Kristiansen, ||| red.) Forlag1. 2009

Von der Lipper, B.

2010 "Gendered War Rhetoric - Rhetoric of Silence" in *Rhetorical Citizenship and Public Deliberation* (Christian Kock and Lisa Villadsen, eds.). (Forthcoming, spring 2010)

Salazar, P. (ed.)

2010 *Gender and Rhetoric – Gender and Public Deliberation* (collection of texts from the project). University of Cape Town

Von der Lipper, B.

2010 "Benevolent Filantrophy, Identification and Gendered Co-optation", in P. Salazar: *Gender and Rhetoric – Gender and Public Deliberation*

Degrees awarded to students attached to the project

Helga Øvsthus Tønder

Master degree

University of Oslo

Ruvimbo Goredemo

Master degree

University of Cape Town

Radiation hardness of some wide band gap materials used for daylight blind UV detectors

Responsible University/Institution:

Det matematisk-naturvitenskapelige fakultet, Universitetet i Oslo

Principal Investigator, Norway:

Svensson, Bengt Gunnar Professor

Prosjektnr: 179898/S50

Financed by RCN (in NOK):

1.4.2007-30.9.2010

2007: **208,000** 2008: **283,000** 2009: **328,000** 2010: **161,000**

Responsible University/Institution, South Africa:

University of Pretoria

Principal Investigator, South Africa:

Auret, Francois Danie Professor

Financed by NRF (in ZAR):

2007: **38, 698** 2008: **368, 790** 2009: **538, 231** 2010: **224, 193**

Original project summary

The performance of UV sensitive detectors has steadily increased over the last decades, and astronomical as well as terrestrial applications benefit from this evolution. These UV detectors have made possible the success of several solar missions and are now also finding application in the fabrication of user-friendly UV detectors for the prevention of skin cancer. However, the common Si-based UV-detectors exhibit some drawbacks that are difficult to overcome, including the issues of cooling and filtering to detect only a specific UV wavelength. These drawbacks can be resolved by using wide band-gap materials like GaN, SiC, ZnO and diamond. These materials can operate at elevated temperatures and, by a proper design, the detector requires no spectral filtering via additional coatings. In particular, their wide band-gaps facilitate the construction of so-called daylight (solar) blind UV detectors which do not respond to radiation from the visible or infrared spectra but only to 'UV light'.

During the manufacturing of UV detectors and in their operation afterwards, defects are introduced in them due to their exposure to energetic particles. In this project we intend comparing the introduction rates of defects in GaN, SiC, ZnO and diamond, during processing as well as afterwards during controlled irradiation with high-energy particles. The results will show which of these four materials is the least affected by radiation. The radiation hardness of the materials will be assessed by, firstly, manufacturing UV

detectors on the four materials and, secondly, exposing them to MeV electrons, protons, He- and heavy-ions and then determining the defect introduction rates and free carrier removal rates. These results will be of great value both fundamentally and to the UV detector and spacecraft industries. The project implies heavy involvement by both research teams and constitutes a good example of sustainable research co-operation on equal partnership.

Summary of main results

We have established a technology for fabricating high quality Schottky barrier diodes (SBDs) on bulk-grown ZnO. A key ingredient in this technology is a pre-treatment of the ZnO surface by hydrogen-peroxide yielding SBDs with rectification up to 8 orders of magnitude even on highly doped material. These SBDs are stable at temperature cycling between 20 K and 500 K. The SBDs, as well as SBDs fabricated on ZnO grown by pulsed laser deposition, have been irradiated with MeV protons and He-ions and the defects thus introduced have been characterised. Further, a rather unique set-up for on-line electrical measurements of irradiated sample structures has been put in operation at the van de Graaff accelerator, University of Pretoria.

Electrical characterization of the highly rectifying SBDs prepared on melt-grown ZnO samples has been performed using the capacitance-voltage technique in the 60 ?

300 K temperature range. The variations of the built in potential and the barrier height with temperature in these SBDs have been deduced. Donor ionization and carrier concentration as a function of temperature have also been observed from the characterization technique used. Minority carrier effects in the SBDs have also been noted from the capacitance voltage measurements. Surface and interface properties of the SBDs have been studied by the capacitance voltage technique in a wide temperature range as well as by the X-ray Photoelectron Spectroscopy. Using current voltage measurements, we have managed to study the effects of polarity on the SBDs deposited on the different polar faces of the bulk ZnO samples. In particular, it is found that the hydrogen-peroxide treatment gives rise to a highly resistive (passivated) and oxygen-rich surface layer promoting metal-oxide formation during metal deposition.

Temperature dependent Hall measurements have been used to study shallow defect levels in hydrothermally (HT) grown n-type ZnO as well as the effects of irradiation on the carrier concentration and mobility in the 20 to 330 K temperature range. Electrical properties of heat treated hydrothermally grown ZnO samples

have also been investigated by Hall measurements and after treatment in the 1100 to 1500 C range, electron mobility values in excess of 1000 cm²/Vs have been obtained. This is a very encouraging result and among the best ones reported in the literature. In this context, intentional introduction of hydrogen has been found to have a beneficial effect on the electron mobility through minimizing ionized impurity scattering by neutralizing (passivating) compensating acceptor-like defects/impurities. During the last year (2009-2010) also the electrical properties of monocrystalline ZnO thin films grown by metal-organic-vapour-phase-epitaxy (MOVPE or MOCVD) have been studied; however, this effort is in its infancy and the film properties are still inferior to those of HT grown bulk samples. Finally, we have constructed a spectral responsivity system to evaluate the UV detector performance of devices that we irradiate. This system allows us to evaluate the effect of radiation on spectral responsivity and quantum yield of UV sensors as function of radiation type and dose.

Main publications

Schifano, R. et al.

2007 "Electrical characteristics of Pd Schottky contacts to hydrogen peroxide treated hydrothermally grown ZnO", *Appl. Phys. Lett.* 91, 193507

Kassier, G.H., et al.

2008 "Hall effect studies of donors and acceptors in different types of bulk ZnO modified by annealing and hydrogen implantation", *Phys. Stat. Sol. (c)* 5, No. 2, 569 – 572

Svensson, B. G. et al.

2008 Hydrothermally grown single crystalline ZnO; characterization and *modification Mater. Res. Soc. Symp. Proc.* 1035, L04-01

Moe Bøseth, T. et al.

2008 "Vacancy clustering and acceptor activation in nitrogen-implanted ZnO", *Phys. Rev.* B77, 045204

Schifano, R. et al.

2009 "Defects in virgin hydrothermally grown n-type ZnO studied by temperature dependent Hall effect measurements", *J. Appl. Phys.*: 106:043706

Monakhov, E. V. et al.

2009 "Zinc Oxide; bulk growth, role of hydrogen and Schottky contacts", *J. Physics D. Appl. Phys.* 42, 153001

Vines, L. et al.

2009 “Effect of high temperature treatments on defect centers and impurities in hydrothermally grown ZnO”, *Physica B – Condensed Matter* 404, 4386

Vines, L. et al.

2009 “Lithium and electrical properties of ZnO”,

Johansen, K. M. et al.

2010 “Interaction of hydrogen with lithium and zinc vacancies in mono-crystalline zinc oxide”, in preparation”, *J. Appl. Phys.* 107, 103707

Pintilie, I. et al.

2010 “Analysis of the electron traps at the 4H-SiC/SiO₂ interface; influence by nitrogen implantation prior to wet oxidation”, *J. Appl. Phys.* 108, 024503

Degrees awarded to students attached to the project

Mrs. M. Diale	PhD (2010)	University of Pretoria
Mr R. Schifano	PhD (2009)	University of Oslo
Mr M.J. Legodi	MSc (2008)	University of Pretoria
Mr H.B. Normann	MSc (2009)	University of Oslo
Mr W. Mtangi	MSc (2010)	University of Pretoria
Mr M. Kvalbein	MSc (2010)	University of Oslo
Mr K-M. Johansen	PhD (2010)	University of Oslo

Dating human occupations and reconstructing the palaeoenvironment in the Middle Stone Age, southern Cape, South Africa

Responsible University/Institution, Norway :

Institutt for geovitenskap, Universitetet i Bergen

Principal Investigator, Norway :

Lauritzen, Stein-Erik Professor

Project no: 180285/S50

Financed by RCN (in NOK) :

1.4.2007-30.9.2010

2007: **173,300** 2008: **197,300** 2009: **197,300**

Responsible University/Institution, South Africa:

University of Witwatersrand

Principal Investigator, South Africa:

Henshilwood, Christopher Professor

Financed by NRF (in ZAR):

2007: **90, 657** 2008: **167, 358** 2009: **708, 291** 2010: **212, 758**

Original project summary

We present a research, networking and training programme centered on the archaeology of the Middle Stone Age (MSA) in the southern Cape region of South Africa. We believe this research will contribute significantly to present knowledge of the MSA in this region and enable fine tuning of current dates for the Still Bay and earlier MSA deposits both at Blombos Cave and for selected caves in De Hoop Nature Reserve. Isotope analysis and uranium series dates of speleothems and flowstones will help refine current understanding of the climate and sea levels during these occupations. The project will provide excellent training in excavation techniques, artefact analysis, dating methods and palaeoenvironmental reconstruction for South African and Norwegian students at graduate, Masters and Ph. D level.

Summary of main results

The dating of the Blombos deposits is in progress and the results for the lower levels indicate a preliminary date of c. 110 ka. A paper to be submitted to the journal *Science* is currently being written based on this date and the finds within these levels. This paper will be submitted in late 2010.

This study focused on reconstructing the palaeoenvironment of the southern Cape during the last 150 ka. A speleothem derived stable isotope chronology was produced for several stalagmites sampled within the De

Hoop Nature Reserve. The speleothems were dated using uranium series techniques from ca. 3.5 to 50 ka and between 102 and ca. 112 ka, respectively.

The stable carbon and oxygen signals were used as vegetation and precipitation proxies, respectively. The pattern identified in the isotope record correlated winter rainfall with C3 vegetation whereas summer rainfall was coeval with a stronger C4 vegetation component. Variations in the amount of precipitation and vegetation composition were congruent with changes recorded in seawater temperatures, ice cores and shifts in the position of the Subtropical Convergence. The De Hoop proxy record suggests a glacial expansion of winter rainfall across the southern Cape coast which is broadly coeval with climatic model predictions.

Using this stable isotope chronology, the intention was to link the speleothem record with the dated occupations at Blombos Cave, thereby establishing if climate change influenced human activity at the site. The implications of these results for archaeological interpretations in this region are also addressed. In addition, this study also considers the forcing mechanisms related to the De Hoop speleothem chronology. This joint research project has been successful in that it has met its aims and the project will continue beyond 2010. It is a good example of a successful collaboration between

complementary researchers, in different fields, and also between two universities, one in Norway and one in South Africa. It has also provided specialized training for a South African student who would not otherwise have had this opportunity. She will now also study

further in this field. This research, that was able to be carried out with the Norwegian Research Council/ National Research Foundation funding, will be published in an international journal in 2011. It will be submitted to *Quaternary Science*.

Main publications

Henshilwood, C.S

“The origins of symbolism, spirituality & Becoming human” *innovation in prehistoric material*

Henshilwood, C.S.

“Winds of change” *palaeoenvironments, material culture and human behaviour in the Late Pleistocene* (Goodwin Volume in honour of Lyn Wadley. South Africa)

Henshilwood, C.S., Errico, F. & Watts, I.

“Engraved ochres from the Middle Stone Age levels at Blombos Cave, South Africa”, *Journal of Human Evolution*

Villa, P., Soressi, M., Henshilwood, C.S. & Mourre

“The Still Bay points of Blombos Cave (South Africa)” *Journal Archaeological Science*

Errico, F. & Henshilwood, C.S

2007 “Additional evidence for bone technology in the southern African Middle Stone Age, South Africa” *Journal of Human Evolution* pp. 142 – 163

Degrees awarded to students attached to the project

Mrs. Jane Noah

MSc (2010)

University of Witwatersrand

From transmission of tradition to global learning: African Islamic education, c. 1800-2000

Responsible University/Institution, Norway :

Det samfunnsvitenskapelige fakultet, Universitetet i Bergen

Principal Investigator, Norway :

Bang, Anne Katrine Forsker

Project no: 180288/S50

Financed by RCN (in NOK):

1.4.2007-31.1.2010

2010: **0** 2007: - 2008: **499,000** 2009: **120,666** 2010: **60,334**

Responsible University/Institution, South Africa:

University of Cape Town

Principal Investigator, South Africa:

Jeppie, Shamil Dr

Financed by NRF (in ZAR):

2007: **86,906** 2008: **203,609** 2009: **355,859** 2010: **70,224**

Original project summary

Researchers from the University of Cape Town and the University of Bergen will collaborate on a historically-grounded project focusing on the growth and transformation of a widespread form of basic traditional education in parts of Africa with large Muslim populations. A central concern of this project is how these institutions have changed and how they are being used in response to a variety of colonial, post-colonial and globalizing pressures.

Summary of main results

The research conducted in this project has showed both the historical lines that guide Islamic educational facilities in Africa, as well as the more recent challenges and changes. Long-standing family-, social strata- or Sufi brotherhood affiliations has, until the late 20th century, tended to guide the type of syllabus and intellectual orientation applied in individual madrasas. However, in the late 20th century,

both the request from parents for new subjects (computer sciences, secular subjects) as well as general challenge from reformist/Wahhabi Muslim groups has led to a re-orientation of syllabi and teaching styles. In addition, Islamic education has increasingly received more diverse funding from beyond the local community. In some cases, this has led to educational facilities being organized more along ethnic lines, especially in multi-ethnic societies (ref. South Africa, Kenya).

The overall trend is towards diversification - both in terms of intellectual content, organizational structure and funding.

A final valuable result of the project has been close collaboration with the researchers and the Islamic schools under study. This has led to joint project application for the preservation of scriptural heritage located in the various schools.

Main publications:

Liazzat J. Bonate

2010 “Islam in Northern Mozambique: A Historical Overview”
History Compass

Anne K. Bang

2011 “Authority and Piety, Writing and Print”. *A preliminary study of the circulation of Islamic texts in late 19th and early 20th century Zanzibar*

Muhammad Khalid Sayyid

2010 “South African madrasahs 1973 – 2010”. *W. Weise (ed.) volume of comparative religion*

S. Jeppie

2010 “Sharia and state in the Sudan: from late colonialism to late Islamism” *In: Meerten B. ter Borg & Jan Willem van Henten (eds.), Powers: religion as a social and spiritual force, pp. 149 – 165.*

S. Jeppie & A. K. Bang

In progress “The African Madrasah Reader”

S. Jeppie, Ebrahim Moosa & Richard Roberts (eds.)

2010 “Muslim family in Sub-Saharan Africa” *Colonial legacies and post-colonial challenges (introduction by editors pp. 13 - 62) and essay “The making and unmaking of colonial sharia”*

Degrees awarded to students attached to the project

Liazzat J. Bonate	PhD	UCT
Shaheed Mathee	PhD (submission 12/2010)	UCT
Muhammad Khalid Sayyid	MA	UCT
Abdulkadir Hashim	PhD	UWC
Ibrahim Moos	MA (submission 12/2010)	UCT

Levels and Implications of Persistent Organic Pollutants and other contaminants in South Africa

Responsible University/Institution, Norway:

Norges veterinærhøgskole

Principal Investigator, Norway:

Skåre, Janneche Utne Forskningsdirektør

Prosjektnr: 180291/S50

Financed by RCN (in NOK):

1.4.2007-30.9.2010

2007: **200,000** 2008: **200,000** 2009: **120,000** 2010: **138,000**

Responsible University/Institution, South Africa:

North West University

Principal Investigator, South Africa:

Bouwman, Hindrid Professor

Financed by NRF (in ZAR):

2007: **94, 622** 2008: **247, 007** 2009: **210, 811** 2010: **485, 558**

Original project summary

The lack of knowledge concerning organic pollutants in South Africa, within the context of the Stockholm Convention (SC) on POPs, is the reason for the thrust of this application. The three partners, the Norwegian School for Veterinary Science (project owner), Norwegian Institute of Air Research, and the North-West University in South Africa, form the consortium for this project.

Through combining existing knowledge, expertise, capacity and resources, we aim to investigate the presence and levels, and determine the preliminary risks associated with selected persistent organic pollutants in soil, bird eggs and human milk from the Vaal Triangle, the most industrialised area in South Africa. Existing data indicates high levels of some of the pollutants, while for others it will be the first such analysis.

By extracting the samples in SA (after training of two NWU persons in Norway), and doing most of the analysis in Norway, we aim to optimise the number of samples that can be done, and generate sufficient knowledge for preliminary risks assessments, identification of priorities and avenues for further investigations, and to contribute towards the SC aims for both countries.

Summary of main results

The main goal of this project was to investigate the presence, levels, and associated risk of

persistent organic pollutants (POPs) in the environment of South Africa. The main study area was in the industrialised area of South Africa. Eggs from wild birds and chickens were analysed for organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs), dioxin-like PCBs and brominated flame retardants (BFRs) such as PBDEs and HBCD. The results so far show levels of heavy metals in soil ranging between 0.001-2500 mg/kg. The distributions of the heavy metals showed a clear association with human activity. Sum OCP and sum PCB levels in the wild bird eggs ranged between 4-2600 ng/g wet weight (ww), and 1-840 ng/g ww, respectively. Residues of pp-DDT were found in all species, and may indicate air-borne transport from areas where DDT is used in malaria control. Sum PBDEs ranged between 0.4-220 ng/g ww. HBCD was found in low levels in all bird species and ranged from 0.2-10 ng/g ww. Diet, trophic level, and habitat associations with humans seem to be the most important factors influencing POP levels in birds eggs. BFRs were measured in highest concentrations in the scavenging African Sacred Ibis. The study found higher mean levels of BFRs in sparrows and weavers than in fish-eating birds, indicating that association with humans is a more important factor for exposure to BFRs than trophic level. Levels and patterns of PCDDs/PCDFs (dioxins) and dioxin-like PCBs in commercial and backyard chicken eggs differed significantly between localities. The levels of dioxins and dioxin-like PCBs, converted to TEQs, warrants further research.

Main publications:

B. Venter, A. Polder, J.U. Skaare, H. Bouwman

2008 “Organochlorine contaminants in cormorant, darter, egret, and ibis eggs from South Africa”, *Chemosphere* 2008. 71; 227 – 24

B. Venter, A. Polder, J.U. Skaare, H. Bouwman

2008 “Polybrominated diphenyl ethers and HBCD in bird eggs of South Africa” *Chemosphere special issue Brominated Flame Retardants* 2008. 73: 148 – 154

C. Nieuwoudt, L.P. Quinn, R. Pieters, I. Jordaan, M. Visser, H. Kylin, A.R. Borgen, J.P. Giesy & H. Bouwman

2009 “Dioxin-like chemicals in soil and sediment from residential and industrial areas in central South Africa” *Chemosphere* 2009. 76: 774 – 783

C. Nieuwoudt, L.P. Quinn, R. Pieters, H. Kylin, A.R. Borgen & H. Bouwman

2009 “Distribution profiles of selected organic pollutants in soils and sediments of industrial, residential and agricultural areas of South Africa” *Journal of Environmental Monitoring* 2009. 11: 1647 – 1657.

C. Nieuwoudt, L.P. Quinn, R. Pieters, H. Kylin, A.R. Borgen

In press «Polycyclic aromatic hydrocarbons (PAHs) in soils and sediment from industrial, residential and agricultural areas in central South Africa: An initial assessment” *Soil and Sediment Contamination: An International Journal*.

Degrees awarded to students attached to the project

Laura Quinn	PhD	North-West University
Claudine Nieuwoudt	PhD	North-West University

Witwatersrand Central Basin Mine Water Apportionment Pilot Study

Responsible University/Institution, Norway:

Norsk institutt for vannforskning

Principal Investigator, Norway:

Røyset, Oddvar Seniorforsker

Prosjektnr: 180292/S50

Financed by RCN (in NOK):

1.5.2007-30.9.2010

2007: **200,000** 2008: **295,000** 2009: **165,000** 2010: **109,000**

Responsible University/Institution, South Africa:

Council for Geoscience

Principal Investigator, South Africa:

Mengistu, Haile

Financed by NRF (in ZAR):

2007: **53, 213** 2008: **312, 250** 2009: **80, 891** 2010: **102, 693**

Original project summary

NIVA and CGS are to embark on a pilot study to develop methodologies and techniques to determine ecological footprints and volumetric contributions for apportioning liability for sustainable management of pollution and water ingress into underground gold mine openings of the Witwatersrand Central Basin, South Africa.

Water is ingressing into the underground mine voids in the Central Rand Basin of the Witwatersrand, necessitating dewatering of operational areas through pumping. Such pumping also ensures avoidance of sterilization of remaining gold reserves.

The CGS has been tasked by the South African Department of Minerals and Energy (DME) to identify sustainable management options to, amongst other objectives, apportion liability of costs to polluters and/or contributors to ingress and water contamination.

Furthermore, regional mine closure strategies are being developed to ensure that there is a financial provision for sustainable environmental management, once mining operations cease. Based upon the polluter pays principle adopted by the DME, apportioning of such financial liability in the industrial area of the Central Rand Basin and environs is critical to implement such mine closure strategies. A scientific basis for such apportionment is planned in this pilot project. This groundbreaking approach has not been attempted anywhere else in the world, and

would serve as a pilot approach for other areas similarly impacted by mining operations in South Africa, and further afield in areas of Africa where an immature mining industry exists.

Apportioning liability for environmental problems is a contentious issue with high potential for legal objections from identified impactors or contributors. The involvement of NIVA, an independent, impartial, non-partisan, and credible international water research institution would bring legitimacy to the research and apportionment process likely to reduce the risk of objections from affected parties.

Summary of main results

The Witwatersrand Central Basin Mine Water Apportionment Pilot Study (Witwater) is a project under the Research Council of Norway RCN South Africa program lasting from 2007 to 2010, between The Council of Geoscience (CGS) in Pretoria and Norwegian Institute of Water Research (NIVA) in Norway. The purpose of this project is to develop new environmental analytical chemical and biological monitoring tools of toxic heavy metals in acid mine drainage waters (AMD) from mines and mining operations. The new methods will be used to assess toxicity of heavy metals towards biota in the aquatic recipients, for general fate and effects assessment, and to improve the management of environmental problems of AMD water. The Witwatersrand region

between Johannesburg and Pretoria is used as test site. In the Johannesburg area, the environmental concern is currently large for flooding of several closed mines. Heavy metal contaminated AMD water may overflow from the mines into surface aquatic ecosystems or groundwater resources.

The DGT (Diffusive Gradient in thin Films) passive samplers are new sampling tools for heavy metals in water. DGTs are useful tools for the collection and determination of the bioavailable and toxic fraction of heavy metals towards organisms in aquatic ecosystems affected by AMD water. In the early phase of the project, DGT samplers have been tested at selected mining sites in the Witwatersrand region to get experience with field sampling, laboratory analysis and evaluations of results. Benthic organism communities (macro-invertebrates) in the aquatic recipients of AMD water will be used as response indicators of the toxic heavy

metals. During second half of 2009 a PhD study was started, where the objectives are an integrated approach to determine toxic metal

fractions with water quality methods and DGT samplers, map the response by macro-invertebrates communities as effect indicators, and use new biomarker methods to further improve the response indicators (based on modern molecular biology methods). This PHD project is in cooperation between CGS and the University of Johannesburg, and is planned to be finished during 2012, and will be an important outcome of this project. The candidate will get new knowledge on how to describe environmental effects of AMD waters. This will be of value for the research community working with environmental problems from mining, and for governmental bodies dealing with regulations of mine water problems.

Main publications:

H Mengistu

2009 “Application of DGT samplers in monitoring of minewaters of the Witwatersrand goldfields”, RSA, Council for Geoscience, Pretoria, South Africa, POSTER, International Mine Water Conference, Pretoria, RSA, 19 -23 October, 2009. Arranged by Water Institute of South Africa (WISA) and the International Mine Water Association.

O Royset *), E Iversen, K J Aanes, Birger Bjerkg

2009 “Water quality and metal transport in water-covered mine tailings deposits at sulphide ore mines – in situ measurements and modeling”, Norwegian Institute for Water Research (Norway), ORAL (by Royset), International Mine Water Conference, Pretoria, RSA, 19-23 October, 2009. Arranged by Water Institute of South Africa (WISA) and the International Mine Water Association.

Haile Mengistu

2009 “Passive samplers as long term monitoring tools in Witwatersrand goldfields”, Council for Geoscience, 280 Pretoria St., Pretoria, South Africa, ORAL, Groundwater 2009 Conference, 16 -18 Nov, NH The Lord Charles, Somerset West, Western Cape, RSA.

A study of HIV and AIDS in relation to people with disability in South Africa

Responsible University/Institution, Norway:

SINTEF - Oslo

Principal Investigator, Norway:

Eide, Arne Henning

Prosjektnr: 180293/S50

Financed by RCN (in NOK):

1.4.2007-1.4.2010

2007: **150,000** 2008: **200,000** 2009: **200,000** 2010: **100,000**

Responsible University/Institution, South Africa:

University of Stellenbosch

Principal Investigator, South Africa:

Swartz, Leslie Professor

Financed by NRF (in ZAR):

2007: **300, 120** 2008: **480, 192** 2009: **934, 192** 2010: **224, 272**

Original project summary

This project aims to look at different aspects of HIV/AIDS and disability in South Africa. It is hypothesized that people with disabilities face a higher risk of HIV infection. To understand the effects of HIV on people with disabilities one must look at the status society awards them in relation to HIV and AIDS, the sexual practices of this group, as well as their knowledge, attitudes, practices and their access to HIV and AIDS prevention programs.

Issues linking disability and HIV and AIDS can be grouped under:

- Sexual Practices
- Vulnerability and issues of sexual abuse
- Lack of accessible information/ Lack of knowledge
- Lack of services that are disability friendly (i.e. are inclusive and welcome the participation of disabled people and are not judgemental in their attitudes and are accessible in all aspects of their operation)

Summary of main results

The project has resulted in a number of scientific publications (list of publications is attached). The project has been carried out in close collaboration with Disabled People South

Africa, and their appointed representative South African minister of Public Works Honorable Hendrietta Bogopane-Zulu. This has resulted in an exceptional awareness about the project among South African government representatives, among them the South African Minister of Health.

HIV/AIDS and sexuality amongst people with disabilities in South Africa. Summary Report November 2009. Pretoria; Ministry of Public Works. The report is attached.

The report was launched at a dissemination seminar in Pretoria in November 2009. The seminar was arranged by South African minister of Public Works Honorable Hendrietta Bogopane-Zulu, on behalf of Disabled People South Africa.

Feed-back workshops carried out in Kwa Zulu-Natal, Western Cape and Gauteng Provinces. The feed-back workshops were arranged in collaboration with Disabled People South Africa (DPSA), and were targeted at local partners, stakeholders and participants/ informants in the three provinces where the study took place. The aim of the workshops was to present major results from the project, in addition to raising knowledge and awareness about HIV/ AIDS. Voluntary Counselling and Testing Services (VCT) were available throughout the feed-back workshops.

Main publications:

- Rohleder, P., Swartz, L., Schneider, M., Groce, N., & Eide, A. H.
2010 HIV/AIDS and disability organisations in South Africa. *AIDS Care*, 22, 221-227.
- Rohleder, P., Braathen, S. H., Swartz, L., & Eide, A. H.
2009 HIV/AIDS and disability in Southern Africa: A review of relevant literature. *Disability and Rehabilitation*, 31, 51 – 59.
- Rohleder, P., & Swartz, L.
2009 Providing sex education to persons with learning disabilities in the era of HIV/AIDS: Tensions between discourses of human rights and restriction. *Journal of Health Psychology*, 14, 601-610.
- Rohleder, P.
2009 'They don't know how to defend themselves': Talk about HIV risk and disability in South Africa. *Disability and Rehabilitation*, Early online, 1-9. Books/ book chapters published (textbooks, anthologies, etc.)
- Rohleder, P., Swartz, L., Eide, A. H., & MacGregor, H.
2009 HIV/AIDS and persons with disabilities. In P. Rohleder, L. Swartz, S. C. Kalichman,., & L. C. Simbayi, (Eds.). *HIV/AIDS in South Africa 25 years on: Psychosocial perspectives* (pp. 289-304). New York: Springer.
- Rohleder, P., Swartz, L., & Philander, J.
2009 Disability and HIV/AIDS: A key development issue. In M. MacLachlan & L. Swartz (Eds.). *Disability and international development: Towards inclusive global health* (pp. 137-147.). New York: Springer

Degrees awarded to students attached to the project

Poul Rohleder PhD Stellenbosch University/ Human Sciences Research Council

The role of social capital in promoting community based care and support for people living with HIV/AIDS in KwaZulu-Natal, South Africa

Responsible University/Institution, Norway:

Det samfunnsvitenskapelige fakultet, Universitetet i Oslo

Principal Investigator, Norway:

Duckert, Fanny Professor

Prosjektnr: 180309/S50

Financed by RCN (in NOK):

1.4.2007-30.9.2010

2007: **95,000** 2008: **179,000** 2009: **189,000** 2010: **144,250**

Responsible University/Institution, South Africa:

University of Kwazulu-Natal

Principal Investigator, South Africa:

Sliep, Yvonne Dr

Financed by NRF (in ZAR):

2007: - 2008: **309, 555** 2009: **555, 247** 2010: **530, 891**

Original project summary

With the number of South Africans infected with HIV/AIDS soon exceeding 6 million, care and support for the people infected and affected is becoming increasingly more important.

Most care and support is carried out in the communities, by community members within a highly stigmatised environment with little government support. It is therefore crucial to strengthen community capacity to provide care and support for the ill. Previous studies have focused on individuals, families, caregivers and organisations providing care separately with little focus on how to these work together. In this study, we explore the levels, elements and mechanisms of social capital in relation to care and support for people living with HIV/AIDS. Social capital is defined as 'the norms and networks that enable people to act collectively'. We examine the three forms of social bonding, bridging and linking at the levels of individuals, families, community based organizations, and government/external agents. According to our knowledge, this is the first study that will be done addressing all three levels of social capital within an HIV/AIDS context. The longitudinal study takes place in a rural poor community in KwaZulu-Natal. We use a multi-method approach within a framework of participatory action research and ethnography. To conduct the fieldwork, we will recruit local people as well as Zulu-speaking students. The

study moves through stages of exploring, analyzing, acting on and evaluating aspects of social capital in relation to care and support in the area. At the end of the study, we aim at creating a local base where agencies and activities can be monitored, assisted and strengthened. This would promote sustainability of the project. An additional outcome of the study is the development of a model to strengthen social capital and improve care and support in similar communities.

Summary of main results

Families and local communities are currently responsible for the majority of all HIV/AIDS care and support activities in South African communities. Our study explored the social aspects of care and support for those infected with HIV through a social capital framework and lens. We hoped through the study to get a better understanding of the social norms, mechanisms and practices related to HIV/AIDS care and support in the communities.

One major finding of our study was that a strong sense of social cohesion and norms exist to govern the way HIV/AIDS care and support activities are carried out and organised at a community level. However, HIV/AIDS has caused these networks to decline, particularly with reference to family and community networks. We further found that although the community contained a range of groups and

organisations working with care and support, they were informal, rather small and lacking in resources. The main challenge to care and support seemed to be the lack of proper organisation, human and physical resources, and communication and coordination of activities rather than a lack of community enterprise.

Home based carers play a key role in HIV care and support activities. They experienced high levels of stress, particularly due to the overwhelming nature of the disease. Lack of social cohesion and awareness of activities carried out by home based carers was identified as major stumbling blocks for their work. Home based carers reported needs for interpersonal and structural support to enable their care work.

An innovative dissemination strategy was developed to share our findings with the community. Narrative Theatre is a way in which participants themselves are actively

drawn in to highlight the results of the research through participatory drama. This has created a good working relationship with the community and strengthened the social value and impact of our research.

The main conclusion of our study is that awareness of and access to linking networks is necessary to successfully organise HIV/AIDS care and support activities. In particular, building networks and maintaining the social norms and values underpinning them requires a diverse and sufficient pool of resources that are not available in our community of study. The main results of our study have been reported in a book that includes contributions from researchers and students attached to the project. In addition, several journal articles, Masters and Honours dissertations, seminar and workshop presentations, manuals, and other dissemination activities have been completed. Two PhD students are also connected to the project.

Main publications:

Sliep, Y, Ubuntu

2010 Relational Generosity. Family, Systems and Health, In Press

Naidu, T., Sliep, Y., & Dageid, W.

2010 Context & the social construction of identity in HIV/aids home based care volunteers in rural KwaZulu-Natal, South Africa, SAHARA, submitted

Naidu, T. & Sliep, Y

2010 Transformative Performance: Co-Constructing Alternative Identity Perspectives Among African Women Home Based Care Volunteers Submitted to peer review journal Qualitative Inquiry, Submitted

Arnesen, A. & Dageid, W.

2010 Resilience, social capital, and well-being: contextual and cultural considerations, submitted

Nesje, K. & Dageid, W.

2010 Self-help groups: getting by or getting ahead, Nonprofit and Voluntary Sector Quarterly, submitted

Gilbert, A. & Sliep, Y.

2009 Reflexivity in the Practice of Social Action: From Self- to Inter-Relational Reflexivity. South African Journal of Psychology, Volume 39 (4) pp, 468-479 Book/article in book/report

Dageid, W., Sliep, Y., Akintola, O., & Duckert, F. (eds)

2010 Response-ability in the era of AIDS: Building social capital in community care and support, book of approximately 250 pages, Sun Media publisher (SA): Bloemfontein, submitted

Chapters in book:

1. Yvonne Sliep, Wenche Dageid, Olagoke Akintola & Fanny Duckert, The role of social capital in promoting community based care and support for people living with HIV/Aids in KwaZulu-Natal, South Africa

2. Wenche Dageid, Spaces of response-ability: A mapping of community perceptions of and participation in HIV/AIDS care and support activities.

3. Fanny Duckert & Staale Tofte Vaage Organizational challenges in creating care and support services for HIV-positive individuals in rural South Africa.
4. Wellington Mthokozisi Hlengwa, The burden of care: A study of perceived stress factors and social capital among volunteer caregivers of people living with HIV/AIDS in KwaZulu- Natal
5. Annette Kezaabu Kasimbazi, Unpaid volunteers and perceived obstacles in ensuring care and support for people living with HIV/AIDS
6. Sharl Fynn, Experiences of social support among volunteer caregivers of people living with HIV/AIDS
7. Fatimah Dada & Yvonne Sliep, Those without the choice to care
8. Nicole D’Almaine, Untapped resources
9. Anette Arnesen, Kjersti Nesje & Wenche Dageid Improving the response-ability of people living with HIV: individual and group factors
10. Mbekezeli Mkhize & Thulasizwe Kuzwayo Observations and Reflections of Fieldwork
11. Thirusha Naidu, Generative metaphor in community based action research: making culturally relevant connections
12. Olagoke Akintola, Home-based care and social capital: Exploring the role of social capital in resource creation and access
13. Yvonne Sliep & Annette Kezaabu Kasimbazi, Taking back practices – Creating reflexive spaces to increase response-ability
14. Wenche Dageid, Yvonne Sliep, Olagoka Akintola & Fanny Duckert, Conclusion and visions: Building social capital in community care and support 2010, Pattman, R; Kasimbazi Kezaabu, A & Sliep , Y: Real men, sick wives and others; dramatic explorations of men and their potential as caregivers in the context of HIV/AIDS in rural KwaZulu Natal in Acting on IV: using drama to create possibilities for change edited by Dennis Francis (currently under peer review)

Sliep, Y

2009 Healing communities by strengthening social capital: A Narrative Theatre approach. Training facilitators and community workers. Training manual published by WTF, Netherlands, ISSN 1571-8883

Degrees awarded to students attached to the project

Annette Kasimbazi	Master	UKZN
Sharl Fynn	Master	UKZN
Wellington Mthokosizwe Hlengwa	Master	UKZN
Nicole D’Almaine	Master	UKZN
Fatimah Dada	Master	UKZN
Lungile Myeni	Honours	UKZN
Anette Arnesen	Master	UiO
Kjersti Nesje	Master	UiO
Therese Sæberg	Master	UiO
Staale Vaage	Master	UiO

Khoe-San Culture, Language and Memory in South Africa

Responsible University/Institution, Norway:

Fakultet for humaniora, samf.vitensk. og lærerutd., Universitetet i Tromsø

Principal Investigator, Norway:

Saugestad, Sidsel Professor

Prosjektnr: 180317/S50

Financed by RCN (in NOK):

1.4.2007-31.3.2010

2008: **190,000** 2009: **220,000** 2010: **40,000**

Responsible University/Institution, South Africa: **University of the Free state, Faculty of Humanities**

Principal Investigator, South Africa:

Besten, Mike Dr

Financed by NRF (in ZAR):

2007: **153, 960** 2008: **723, 591** 2009: **363, 239** 2010: **255, 730**

Original project summary

The project has two components:

One component comprises networking and research collaboration with regional universities with research profiles addressing Khoe-San/indigenous issues (e.g. University of Namibia, University of Botswana and the University of the Western Cape) and the University of Tromsø, through the Department of Social Anthropology and the Centre for Saami Studies. These activities will contribute to the development of Khoe-San research competence and capacity at the University of the Free State. The main collaborators in the Culture and Memory project will serve as a reference group for the research project, advise PhD students affiliated with the project, and carry out independent fieldwork as appropriate.

The other component is a longitudinal interdisciplinary research project, involving anthropologists, historians and linguists, embedded in the network activities. The

research will examine the nature and dynamics of Khoe-San culture, language, memory, identities and representations in South Africa. Drawing especially on data from the 1936 South African population census, which also enumerated Khoe-San language speakers, the project will seek remaining Khoe-San language speakers in the country (a number of whom have already come to the fore after 1994), as well as their immediate descendants, and record and analyse their cultural and linguistic memories and life histories. Their life histories should yield valuable insights into the historical dynamics of Khoe-San culture, language, identity and memory in South Africa. Their life histories and memories should also challenge widely held misconceptions about the Khoe-San heritage in South Africa, especially the view that the Khoe-San and their cultures and languages are long extinct. This perception has inclined those in positions of power, including academics, to neglect the living Khoe-San heritage.

Summary of main results

One of the main project objectives has been the identification of people who can speak Khoe-San languages in South Africa. The 1936 population census, which identified the amount of speakers as well as the places where were then located, was an important guide. The census, which indicates that nearly 4000 people across South Africa spoke a Khoe-San language, had the potential to challenge the view that there were no longer people in South

Africa who spoke the Khoe-San language variants !Ora (Korana) and Xiri (Griqua). Only two people were found who had reasonable facility with each of the variants. Many more were found who remembered Khoe words or who could make a few sentences. These Khoe-variants appear to be only used occasionally. It is possible that there are more people with a facility with !Ora and Xiri. From the data gathered it is evident that !Ora and Xiri are not two distinct languages but related

dialects that are mostly mutually intelligible and also closely related to still widely used Khoekhoegowab (Nama/Damara/Hai||om). The fieldwork carried out covered a wide area but it was not exhaustive. Finding speakers was extremely difficult. With the exception of a few places Khoe-San are minorities in areas in which they live. People who constitute the majority ethnic groups are in many places not even aware of the presence of people who identify with a Khoe-San category or who can speak some of a Khoe-San language. As such they are overwhelmed by dominant ethnic identities and languages. This shows that Khoe-San identities and languages are often hidden.

The public interviews conducted reflect much ignorance about the Khoe-San. The interviews

also indicate that many people are keen to know more about the history, culture and languages of the Khoe-San people. This shows a need for accurate and detailed information to be availed more easily to interested members of the public, students and government officials.

The Department of Anthropology, UFS, and Unit for Khoe-San studies, which is under the auspices of the department, are currently preparing plans for a multi-disciplinary Masters degree in Indigenous studies at UFS, to start up in January 2013. This programme will be the first of its kind offered on the African continent. It will recruit students from Botswana and Namibia, and will strengthen the position of UFS as a leading university on indigenous issues in RSA.

Main publications

Besten, Mike

The Ghost of Theal: Representation of the Khoe-San in South African School History Books
Under review

Besten, Mike

2009 We are the original inhabitants of this land: Khoe-San identity in post-apartheid South Africa UCT Press M. Adhikari 2009 Cape Town

Saugestad, Sidsel

2009 Besværlige urfolksrettigheter i Afrika - Tilfellet Kalahari Ordfront Lars Elenius Stockholm

Degrees awarded to students attached to the project

Siv Øvernes

PhD (2008)

UiT

Teboho Pitso

MA Indigenous studies

UiT

Emmanuela Hinda

Honours (2009)

UFS

Menan du Plessis

PhD (2009)

University of Cape Town

Land at last - Criteria for success in South African land redistribution

Responsible University/Institution, Norway:

Norsk institutt for by- og regionforskning

Principal Investigator, Norway:

Wiig, Henrik Postdoktorstipendiat

Prosjektnr: 180318/S50

Financed by RCN (in NOK):

1.4.2007-31.3.2010

2007: **215,871** 2008: **270,172** 2009: **144,801** 2010: **50,000**

Responsible University/Institution, South Africa:

University of Kwazulu-Natal

Principal Investigator, South Africa:

May, Julian Director

Financed by NRF (in ZAR):

2007: **5, 165** 2008: **264, 840** 2009: **83, 232** 2010: **159, 075**

Original project summary

The black population expected redistribution of land when the apartheid regime fell. However, the land reform had a rather slow start but the redistribution program is now speeding up.

Close to 15.000 households are now receiving grants each year, which is mainly used to buy land which was earlier part of large estates owned by white commercial farmers. The South African Land Reform Program first only benefited poor families, but more successful entrepreneurs can now receive grants to as part of the black empowerment approach. As land redistribution speeds up, it becomes vital to analyse the experience until now in order to make

program as useful as possible towards its twin ends: (i) poverty alleviation and income redistribution and (ii) black empowerment.

We will have access to a novel cross section data set from the Quality of Life 2005 survey made by the South African Land Reform Program. Its specific design with 2000 program beneficiaries and 2000 pairwise "identical" non-beneficiaries opens for valid impact assessment of the program. The large number of observations furthermore makes it possible to single out the characteristics of the households and communities that have been able to improve their lives through the land grants compared to the less successful ones. Are the individual characteristics like education that is most important, or to access to infrastructure, transport and the local institutions and social capital more important? What is the role of regional differences that is

already reflected in the existing income distribution.

The results from this econometric analysis is the starting point for a quantitative field studies that will disclose the dynamics of how the significant variables actually affects the results. This will be a separate result in itself, and in addition opens for more specific design of the econometric models in a second iteration.

Summary of main results

The quantitative analysis and our own re-visits to the same interviewees in the QoL data set shows the data are probably collected in a sensible manner. Most inputs have a significant positive impact, and our qualitative interview information was in accordance with the data given in the QoL data set.

One important result is that most projects does not seem to use all their land available. The reason seems to be a lack of money to invest, and a mixture of management failures and real commitment to the project by the beneficiaries. The amount of land turns out to be insignificant for project income per household in the quantitative analysis. It also shows a quite high attrition of projects as time passes by, something which is confirmed by our interviews which shows conflicts turn up over time, a loss of confidence in the project and a pressure to sell by the less active beneficiaries as alternative uses of the land gives a high sales value.

Main publications

May, Øien and Wiig Forthcoming	Narratives of success and failure in land reform: The case of South Africa
May, Bjaastad and Wiig Forthcoming	The lucky few? Socio-economic characteristics of South African's land reform beneficiaries
Slørstad and Wiig Forthcoming	Impact of land redistribution on consumption in South Africa
Wiig and May Forthcoming	Land at last: Determinants of success in South Africa's land reform program
Øien and Wiig Forthcoming	Subdividing for success? The farm size-productivity relationship in the South African land reform

Degrees awarded to students attached to the project

Mimi Ndokweni	PhD	U. Kwazulu Natal
Portia Ngxangane	Honours	U. Kwazulu Natal
Menziwokuhle	Masters	U. Kwazulu Natal
Henning Øien	Masters	NIBR/UiO
Jarle Slørstad	Masters	NIBR/UiO

The WTO-Doha and the Economic Growth for The Rural Poor

Responsible University/Institution, Norway:

Universitetet for miljø- og biovitenskap

Principal Investigator, Norway:

Schulz, Carl-Erik Professor[‡] (until Nov. 2008)

Wisborg, Poul Professor

Prosjektnr: 180319/S50

Financed by RCN (in NOK):

1.4.2007-30.9.2010

2007: **167,000** 2008: **157,000** 2009: **98,000** 2010: **89,000**

Responsible University/Institution, South Africa:

University of Western Cape

Principal Investigator, South Africa:

Jacobs, Peter Dr.

Financed by NRF (in ZAR):

2007: **99, 973** 2008: **347, 254** 2009: **178, 662** 2010: **66, 746**

Original project summary

Agricultural trade liberalization is high on the agenda for the World Trade Organisation, specifically underscoring the potential positive effects for the world's poor. This project will study how better international market access will trickle down to rural livelihoods in the developing world. The project focuses on the effects from trade to rural economic growth and development. Based on a theoretical analysis of these effects both short run and long run effects will be studied, using data from South Africa. The project will study both the direct effects for agricultural products, and indirect effects from improved market access.

Summary of main results

Market-oriented restructuring of the agricultural sector in South Africa started in the late 1980s and has accelerated following the end of apartheid and the deregulation of the farming sector from the late-1990s onwards. A stated objective of this policy shift has been to improve market access for smallholder farmers, farm workers and informal traders who faced marginalization and exclusion from profitable agricultural markets under apartheid. Such reforms are also assumed to stimulate local and international competition and trade, and to increase the contributions of farming to employment, incomes and economic growth. It is debated how agro-food markets can work for the rural poor, particularly in poorer countries with large agricultural sectors and rural populations, where the effects of market-oriented reforms tend to be

unevenly spread across poor and non-poor social groups. This project therefore aims to improve the understanding of the how global agricultural markets may contribute to economic growth for the rural poor in post-apartheid South Africa.

The study uses economic data on trade, production and consumption and focused studies of the livelihoods of smallholder farmers. Fieldwork has been carried out in Limpopo Province and in the Eastern Cape Province where results have been shared and discussed in workshops.

Major findings and observations include:

- Agro-food systems. We found that 65%-80% of sampled households buy at least half of their bulk monthly food supplies from supermarkets. Given the large share of foods purchased from supermarkets in total household food spending, rural net consumers are particularly vulnerable to food price inflation. The findings have implications for the governance of agro-food networks, the impact of rapid food price inflation in South Africa, and food and agricultural marketing policies.
- Livestock farming- a study on local sheep markets has examined why small scale producers, who participate in both formal and informal markets, tend to sell at lower prices than the national market. The findings suggest that this is due to poor access to information, power relations, and

precarious livelihoods leading to distress sales.

- A study of mango value chains examined how transaction costs bars small-scale mango producers from entering global market and identified ways to lower such costs.
- Gender and structural inequality. A gender-based analysis of the survey data reveals that structural inequalities exist between rural men and women: many rural women are better educated than men but remain at the bottom of the rural social pyramid. This is evidenced by their limited access to farm and non-farm assets as well as household spending levels below common poverty lines. This suggests that institutions in rural society work against the participation of rural women in agro-food value chains as farm workers, traders and smallholder farmers. This situation calls for policy interventions to clear the structural impediments to gender equity. Gender equity in the distribution of critical farm

assets remains a vital step for the transition to secure and sustainable livelihoods.

The project findings suggest that the agro-food markets affect the rural poor (smallholder, farm workers and informal traders) in complex ways that differ from neo-classical textbook stories. A small number of large-scale farmers and agribusinesses remain competitive in the commercial farming sector, which displays rising levels of concentration in a narrow, pyramid-like structure.

Farm workers are becoming more impoverished as they are squeezed in agricultural labour markets and agro-food output markets. Other sectors of the rural poor, specifically smallholder farmers and informal traders, face similar pressures as a result of the market-oriented restructuring of food and agricultural value chains. The findings have implications for the governance of agro-food networks and for the impact of rapid food price inflation and South Africa's policy responses to it.

Main publications:

Aphane, Mogau; Dzivakwi, Robert & Jacobs, Peter T.
Forthcoming Livelihood strategies of rural women in Eastern Cape and Limpopo. *Agenda*.
(Special Issue: Gender and Rurality)

Jacobs, Peter T.
Forthcoming Agro-food market policy and food security in South Africa. *Development In Practice* (Oxfam, UK). (Special Issue: Food Price Crisis)

Degrees awarded to students attached to the project

Robert Dzivakwi	M.Econ	University of the Western Cape
Mogau M. Aphane	M.Econ	University of the Western Cape
Ndiafhi D. Kwindu	M.Econ	University of the Western Cape

Broken Women, Healing Traditions? Indigenous resources gender Critique and Social transformation in the Context of AIDS in South Africa.

Responsible University/Institution, Norway:

Det teologiske fakultet, Universitetet i Oslo

Principal Investigator, Norway:

Salomonsen, Jone Professor

Prosjektnr: 180322/S50

Financed by RCN (in NOK):

1.7.2007-30.9.2010

2007: **170,543** 2008: **282,047** 2009: **224,047** 2010: **357,526**

Responsible University/Institution, South Africa:

University of Kwazulu-Natal

Principal Investigator, South Africa:

Phiri, Isabel Apawo Professor

Financed by NRF (in ZAR):

2007: **23, 819** 2008: **338, 861** 2009: **294, 713** 2010: **377, 240**

Original project summary

The success in combating AIDS may depend upon whether we are able to support women's agency and emerging leadership roles, overcome the overly moralist and curative discourse of AIDS and extend the field to include a deeper, communal healing approach. This must include women's yearning for radical social change, be alert to a new field of ritual invention and appropriation at the interface of Christian and indigenous resources. In this field mother's try to protect their daughters, rework violent experiences and invoke new hopes for the future by renegotiating faith and what it means to live womanly with balanced social relations. The yearning for change has the effect of ongoing creative activity in reconstituting rituals and making them new and powerful in the present. Our research will be based on ethnographic and narrative methods and contribute to an understanding for why women re-appropriate African indigenous knowledge systems in order to find tools for healing and fight for social and gendered changes. What do these resources consist of, and to what extent do they include visions of new partnership models between women and men? Which roles do mediators as male and female Sangomas play in interpreting, bridging and filling them with power? It is important to learn how this work is orchestrated socially and incorporated ritually to help guard integrity and boundary of the subject. Re-appropriation of tradition is not a culturally or politically innocent move but is itself in need of critical examination, in our case, with the discipline of theology and its critical discourse on autonomy

versus interdependence. This study provides new knowledge for critical gender studies and the religious construction of gendered personhood. It raises critical questions for how we construct interventions in the field by asking how we can contribute to building healing communities of active prevention and self-education.

This is a study of how indigenous social and religious resources are retrieved in order to assist just power relations between women and men in context of AIDS. By drawing upon African and Christian interreligious practises in the making and social recognition of protective, ritual and untouchable space, we will contribute to build healing communities of active prevention and self education.

Summary of main results

In 2008 the project arranged the seminar "AIDS, Gender and Religion" in Oslo where some of the researchers contributed as key note speakers. The researchers attended the Joint Conference of Academic Societies in the fields of Religion and Theology in Stellenbosch, South Africa, where they held several presentations from the research conducted in the project, gave one keynote lecture and hosted three paper panels.

In addition to published scientific articles, the project's final conference, arranged at the University in Oslo in May 2010, was the most important activity for the researchers to

disseminate their research findings to the academy.

The researchers have also contributed as key note speakers and papers presenters at other conferences across the world, such as at the Chotro 2 Conference, Asian Commonwealth Language and Literature Society in India, the World Council of Churches Commission on Education and Ecumenical Formation in Switzerland, and the Ritual Dynamics and the Science of Ritual International conference in Germany.

Some of the Norwegian researchers have given popular-science presentations at the national radio stations NRK P1 and P2 and Salomonsen has given a presentation in the magazine Apollon. The researchers have contributed with articles in various anthologies and reports that have been published in both

South Africa and Norway, such as Journal of Theology for Southern Africa, Evangelical Christianity and Democracy in Africa and Pieties and gender.

The project has created the ethnographic film "UMEMULO 2005. Animal sacrifice and human rites (of passage) in the context of Aids in Africa" with filmmaker Jerome Alary based on footage from rituals in Mpophomeni. The film has been screened in USA, South Africa and Norway in order to get critique and to disseminate the work of the project. The film has also been used in teaching. The researchers have started the work of writing two books based in the research that has been conducted in the project. The books will be published at renowned publishing houses in South Africa.

Main publications

Salomonsen

2009 The Power and Ambiguity of Symbols: Contemporary Religion and the Search for a Feminine Divine, Pieties and Gender, Brill Academic Publishers L. Sjørup, H.R. Christensen 230-265
2009 9,789E+12

Salomonsen

2009 Witches' Initiation - A Feminist Cultural Therapeutic? Handbook in Contemporary Paganism, Brill Academic Publishers, M. Pizza, J.R. Lewis, 450-475 2009 9,789E+12

Balcomb

2009 Re-enchanting a disenchanted Universe - postmodern projects in theologies of space, Religion & Theology 77-89 Vol 16/1 2009

Balcomb

2010 Narrative Theology and structures of power ? serious stories of serial misunderstandings
Journal of Constructive Theology Forthcoming Dec 2010

Hafstad

Forthcoming 2011 Untouchable space and the Ethical Imperative of Bodily Shields and Shelters
South African Journal of Theology

Nadar

2009 Her-stories and her-theologies: charting feminist theologies in Africa. Studia Historiae Ecclesiasticae XXXV, Supplement, 135-150 December 2009

Nadar

2009 The Feminist Teacher: Pedagogy Of The Oppressed Woman? Journal of Constructive Theology, 37-56, 14/1 and 15/2, 2009

Phiri and Nadar

2010 Talking back to Religion and HIV&AIDS using an African feminist missiological framework: Sketching t Journal of Constructive Theology Forthcoming Dec 2010

Phiri

2008/2009 African Theological Pedagogy In The Light Of A Case Study On Gendered Violence
Journal of Constructive Theology, 109-124, Vol. 14.2/15.1, Dec 08/Jul09

Phiri

2008 Major challenges for African women theologians in theological education (1989-2008)
Studia Historiae Ecclesiasticae 63-81 34/2/ December 2008

Salomonsen

2008 Shielding girls at risk of AIDS by weaving Zulu and Christian ritual heritage Broken Bodies,
Healing Traditions Cluster Press, Forthcoming 2008 Pietermaritzburg

Salomonsen

2009 The power and ambiguity of symbols, Pieties and gender Brill, Lene Sjørup and Hilda Røhmer

Phiri

2007 A sostegno della vita. La riflessione theologica Africana su Hiv e AIDS CONCILIUM, 54-63,
mar.07.

Salomonsen

2008 From Africa to the Americas and Back: Ritual Transport and Transformation at the Crossroads
betwe... Religion in a Globalised Age, Novus Press 2008 Oslo, Pietermaritzburg, RSA.

Phiri

2009 Xenophobia/Afrophobia in Post-Apartheid (South Africa: Strategies for Combat Theologica
Viatorum: Journal of Theology and Re..., 216-241 33/2, 2009

Hafstad

2008 Blind spots: Obstructions of Mind Against Caring Communities. Broken Bodies, Healing
Traditions, Cluster Press , Forthcoming 2008, Pietermaritzburg

Degrees awarded to students attached to the project

Ida E. Wagle

Master in Religion and Society

UiO, Faculty of Theology

Marie S. Thorstensen

Master in Religion and Society

UiO, Faculty of Theology

DDT and "current use pesticides" in mothers and children in a malaria control area in South Africa

Responsible University/Institution, Norway:

Norsk institutt for luftforskning

Principal Investigator, Norway:

Kylin, Henrik Seniorforsker (until Sep. 2009)

Sandanger, Torkjel

Prosjektnr: 180325/S50

Financed by RCN (in NOK):

1.7.2007-30.9.2010

2007: **150,000** 2008: **210,000** 2009: **126,666** 2010: **128,334**

Responsible University/Institution, South Africa:

Medical Research Council

Principal Investigator, South Africa:

Röllin, Halina Dr.

Financed by NRF (in ZAR):

2007: **150, 937** 2008: **397, 312** 2009: **173, 750** 2010: **413, 000**

Original project summary

The effects of environmental pollutants on human health are often subtle, long-term, sometimes transgenerational and difficult to measure even in long-term epidemiological studies in large populations. There is therefore a need for comprehensive research that monitors the concentration and distribution of toxic substances in humans. A number of persistent toxic substances are recognised as being responsible for adverse development and health effect in children. The growing foetus and newborn child are especially sensitive to the toxic effects of many environmental pollutants, and several of them move from mother to foetus via the umbilical cord and to the child via mother's milk. Of particular concern are long-term, subtle effects that might influence reproductive health, pregnancy outcomes, reduce defence against diseases, affect the children's mental development, or increase the risk of cancer.

Within this project we intend to obtain data on the current levels in mother's blood and milk of DDT and other pesticides used for malaria vector control and/or in agriculture in Northern KwaZulu-Natal, to evaluate the exposure to foetuses and children of the target chemicals,

and to investigate if their main source is the malaria control programme or agriculture. We will take samples from areas where there is an active malaria vector control with DDT and other compounds and from areas where malaria vector control is not needed. In KwaZulu-Natal such areas are located quite close to each other and have essentially the same conditions for agriculture and social life. We, therefore, expect to be able to distinguish between pesticide residues that are due to malaria control activities and those that have other sources, e.g., agriculture. The data will be compared with general medical history, reproductive outcome and child development. Ultimately the data can be used in policy decisions on appropriate malaria vector control procedures.

Summary of main results

Extremely high human DDT levels in communities where DDT spraying is ongoing. The levels are nevertheless highly variable even within a spraying area suggesting differences in applications or differences in private dwellings.

The CUP data are not ready yet. This will be produced for the final report.

Main publications:

Rudge C, Rudge M, Calderon I, Volpato G, Silva J, Duarte G, Neto C, Sass N, Mattar R, Röllin H, Thomassen Y, Odland J.

2011 Toxic and essential elements in blood from delivering women in selected areas of São Paulo State, Brazil. *Journal Environmental Monitoring* 2011 Advanced article, DOI:10.1039/C0EM 00570C (in press).

Rudge C, Sandanger TM, Röllin HB, Calderon I, Volpato G, Silva J, Duarte G, Neto CM, Sass N, Mattar R, Odland J Ø, Rudge M

2010 Levels of selected persistent organic pollutants in blood from delivering women in seven selected areas of São Paulo State, Brazil. Submitted Environment International, October 2010 (under review)

Linda Hanssen, Halina Röllin, Jon Øyvind Odland, Morten K. Moe, Torkjel M Sandanger.

2010 Perfluorinated compounds in maternal serum and cord blood from selected areas of South Africa: results of pilot study. J. Environ. Monit., 2010,12,1355-1361.

Röllin HB, Sandanger TM, Channa K, Hansen L, and Odland JØ.

2009 Concentration of selected persistent organic pollutants in blood from delivering women in South Africa. Sci Total Environ, 2009, 408, 146-152

Rudge CVC, Röllin HB, Nogueira CM, Thomassen Y, Rudge M and Odland JØ.

2009 The placenta as a barrier for toxic and essential elements in paired maternal and cord blood samples of South African delivering women. J. Environ. Monit.,2009, 11(7), 1322-1330.

Röllin HB, Rudge CVC, Thomassen Y, Mathee A, and Odland JØ.

2009 Levels of toxic and essential metals in maternal and umbilical cord blood from selected areas of South Africa – results of a pilot study. J. Environ. Monit., 2009, 11(3): 618- 627.

Degrees awarded to students attached to the project:

Cibele Rudge PhD UNESP, Botucatu, Brazil (awarded) & University of Tromsø

Kalavati Channa/ registered for PhD/ in progress

Southern Ocean Biogeochemistry: Education and Research

Responsible University/Institution, Norway:

Uni Research AS

Principal Investigator, Norway:

Bellerby, Richard G J Seniorforsker

Prosjektnr: 180328/S50

Financed by RCN (in NOK):

1.4.2007-30.9.2010

2007: **360,000** 2008: **130,000** 2009: **60,000** 2010: **106,000**

Responsible University/Institution, South Africa:

CSIR

Principal Investigator, South Africa:

Monteiro, Pedro M.S. Dr.

Financed by NRF (in ZAR):

2007: **73, 519** 2008: - 2009: **576, 168** 2010: **669, 157**

Original project summary

With extreme oceanographic variability over very short distances, the waters around South Africa provide a wealth of information on the mechanistic controls on marine biogeochemical variability. South African waters occupy a special niche in oceanography lying at the junction between western and eastern boundary systems and the Southern Ocean. This natural laboratory offers a special opportunity to research oceanographers to study a range of different mechanisms impacting on the regional biogeochemistry. Both natural and anthropogenic forcing has an effect on each of these different systems with analogous implications for marine systems elsewhere. Understanding these mechanisms is necessary for developing accurate models of the biogeochemical response of the oceans to (inter alia) changes in atmospheric characteristics such as the Antarctic Circumpolar Wave (Southern Annular Mode) and Benguela Ninos. The Southern Ocean is considered to be one of the two, North Atlantic being the other, most important ocean sinks of anthropogenic CO₂. However, the Southern Ocean remains one of the least sampled and understood ocean domains. The approach in this proposal is to train and educate South African Oceanographers and Students through joint research using a combination of observations and diagnostic modelling to understand the carbon biogeochemistry of the Antarctic and sub-Antarctic. Importantly, this approach builds on existing strengths within each of the collaborating groups. This initiative

is contextualised within the IPY global effort. The proposed approach is to synthesise recent literature, re-analyse the data archives and to increase knowledge through observations from 2 project cruises. Subsequent data analysis will result in the production of scientific peer reviewed journals and 2 South African PhDs

Summary of main results

The objective of the Southern Ocean Biogeochemistry: Education and Research (SOBER) was to strengthen the capability of SA science in the important field of climate and biogeochemistry. The strategy in SOBER was to use a combination of observations and diagnostic modelling to understand the carbon biogeochemistry of the Antarctic and sub-Antarctic. Collaboration between staff and postgraduate students from Norway (Bjerknes Centre for Climate Research (BCCR), University of Bergen, the University of Cape Town (UCT) and CSIR, South Africa has resulted in two major research expeditions between Cape Town and Antarctica. The preliminary findings of these expeditions are bearing considerable fruit and we have developed a better understanding of Southern Ocean ocean-atmosphere CO₂ exchange, ocean carbon and nutrient biogeochemical processes which are essential for regional and global climate prediction. This is recognised in the emerging scientific output with key scientific peer-reviewed papers. This will be a major platform for the future South African Norwegian collaboration. This project has made a strong impact in supporting a number

of well coordinated institutional strategies and through the building of long term collaborative links to ensure that its products lead to strong long term outcomes both in the excellence of science as well as in addressing the significant shortage of high calibre scientists in Southern Africa. In the short period since the start of SOBER we have developed the following demographic of young South African scientists (2 post docs: 1 black male and 1 white female); 1 PhD (black male); 3 MSc (2

white females and 1 white male) and taught a new cohort of South African students. We have developed an international partnership which, through strategic networking, has led to successful collaboration through funded EU FP7 programmes. Through the dissemination extension of the project, the consortium has developed, through an international symposium, a long term study programme of the biological carbon pump of the Southern Ocean.

Main publications

- J. K. Egge, T. F. Thingstad, A. Larsen, A. Enge
Primary production during nutrient-induced blooms at elevated CO₂ concentrations. *Biogeosciences*, 439-451, 6
- Zhang et al.,
Natural and human-induced hypoxia and consequences for coastal areas: synthesis and future developme, *Biogeosciences Discuss*, 11035?11087, 6
- Naqvi, SWA et al.,
Coastal hypoxia/anoxia as a source of CH₄ and N₂O, *Biogeosciences Discuss*, 9455?9523, 6
- Bellerby Richard
Polar, Environment and Climate Change Research, Shanghai
- Waldron, H.N., Monteiro, P.M.S., Swart., N.C
Carbon export and sequestration in the Benguela upwelling system: lower and upper limits, *Ocean Science*, 711?718, 5
- Scholes, RJ, Monteiro, PMS, Sabine, CL, Canadell
Systematic long-term Observations of the Global Carbon Cycle Trends in Ecology and Evolution, 427-430, 24(8)
- Takahashi T., Sutherland S., Wanninkhof R., Swe
Climatological Mean and Decadal Change in Surface Ocean pCO₂, and Net Sea-air CO₂ Flux over the Glob, *Deep-Sea Res*, 554?577, 56
- Hauck J., Hoppema M., Volker C., Bellerby R.G.J. a
Observations of acidification in the Weddell Sea on a decadal time scale, *Journal of Geophysical Research*, in press
- Hoppema, M., Velo, A., van Heuven, S., Tanhua,
Consistency of cruise data of the CARINA database in the Atlantic sector of the Southern Ocean, *Earth Syst. Sci. Data*, 63-75, 1
- Hutchings, L., C.D. van der Lingen, L.J. Shannon,
The Benguela Current: An ecosystem of four components, *Progress in Oceanography*, 15-32, 83, Cape Town
- Vázquez-Rodríguez, Lo Monaco, Waugh. Padin, Beller
2008 Atlantic Ocean: comparison of four data-based calculation methods, *Biogeosciences Discussions*, 1421-1433 5, 2008
- Monteiro, P.M.S.
Carbon Fluxes in the Benguela Upwelling System, Carbon and Nutrient Fluxes in Continental

Margins: Springer: Liu, K.-K., Atkinson, L., Quiñones, R. and Talau
Breitbarth E., Bellerby R.G.J., Neill C., Ardelan

Ocean acidification increases bioavailability of iron, Biogeosciences Discussions, 6781-
6802, 6

Degrees awarded to students attached to the project:

Gisle Nondal

PhD

UiB

Gobies and hake in the hypoxic waters of the Benguela up-welling current

Responsible University/Institution, Norway:

Det matematisk-naturvitenskapelige fakultet, Universitetet i Bergen

Principal Investigator, Norway:

Palm, Anne Christine Utne Forsker

Prosjektnr: 180329/S50

Financed by RCN (in NOK):

1.4.2007-30.9.2010

2007: **300,000** 2008: **250,000** 2009: **200,000** 2010: **105,000**

Principal Investigator, South Africa:

Gibbons, Mark Prof

Financed by NRF (in ZAR):

2007: **5, 436** 2008: **495, 773** 2009: **164, 885** 2010: **142, 540**

Original project summary

Our aim is to investigate how the goby (*Sufflogobius bibarbatus*) and the shallow water hake (*Merluccius capensis*) cope with the hypoxic waters of the Benguela current. Both are key species of the ecosystem. They show a remarkable tolerance to the hypoxic conditions found in this up-welling area, which is one of the five most productive marine ecosystems of the world. Due to high sedimentation rate, large areas of the shelf are covered with hydrogen sulphide sediments, making hypoxic conditions above and in the water column. As key species with strong influence on the ecosystem functioning and productivity, these species ought to have evolved a very special physiology and behaviour making them so successful in this extreme marine environment.

We will use new acoustic methods (developed by Norwegian partners) to find individual hake and goby, and track their swimming patterns in the field. This method allows us to investigate (in the field) how the two species respond to changes in oxygen, sulphide and predator-prey conditions. To test our field generated hypotheses, we will conduct laboratory experiments where we will study their physiology and behaviour. Controlled experiments allow us to control water conditions (oxygen, sulphide levels), as well as to monitor the individual fish's swimming speed and activity level.

Our research questions are based on pure, curiosity-driven research but they have applications for fisheries management. We will use an interdisciplinary approach wherein marine ecologists, environmental biologists, physiologists, fisheries biologists and behavioural ecologists will meet and work

together. The new acoustic knowledge that the project will deliver may be a big step forward for the South African fisheries management institutions in their estimations of species abundance using acoustic techniques. Through the project we will provide common research opportunities for scientists and post graduate students in the South Africa and Norway

Summary of main results

Over-fishing off the south west coast of Africa, in the late 1960's, led to the regional loss of the main prey species, sardines (*Sardinops sagax*), resulting in two significant changes to the ecosystem; i) a vast increase in jellyfish biomass and ii) the Benguelan bearded goby (*Sufflogobius bibarbatus*) becoming the new predominant prey species.

Ecological theory predicts that the goby should suffer elevated mortality, but surprisingly they are thriving. Our research findings provide evidence to how this unusual little fish survive in an environment that is toxic to other fish and shellfish. Due to extraordinary physiological adaptation this fish is able to sit the whole day on the hypoxic and sulphide rich bottom, where it holds its breath while feeding on the sediment and animals living within it. At night it swims up in to the more oxygen rich water, where it reoxygenates its body and digests its food. While holding it's breath it feasts on the sulphidic mud.

It also thrives among jelly: When it swims up, it enters layers of jellyfish, layers that other fish avoid. Our behavioural experiments show quite clearly that goby predators will avoid jellyfish,

but that gobies are largely indifferent to them and sat on the jellyfish bell, or swam between the jellyfish's stinging tentacles. By this set of behavioural strategies the gobies minimise their risk of predation.

Previous increases in jellyfish populations have been regarded as a trophic dead-end. Results from our project provides evidence that challenges this view; isotope signatures from

the bearded gobies body tissue reveal that they feed on jellyfish and diatoms mud, transferring these non-commercial resource back in to the food chain. Biomass conservation and production in this ecosystem may therefore be more stable than previously predicted, providing a shift in our understanding of ecosystem functioning.

Main publications

Utne-Palm, A.C., Salvanes, A.G.V., Currie, B., Kaartvedt, S., Nilsson, G.E., Braithwaite, V., Stecyk, J.A.W., Hundt, M., Flynn, B., van der Bank, M., Peard, K.R., Lunde, I.G., Sandvik, G.K., Klevjer, T.A., Pittman, K., Sweetman, A., Strandabø, R.A.U. and Gibbons, M.J.
2010 Tropic structure and Community Stability in an Overfished Ecosystem. *Science*, 329: 333-336.

Gunawickrama K.B.S., De Silva P.M.C.S., Johansen T., Salvanes A.G.V., Nævdal G.
2010 Preliminary evidence for genetic heterogeneity of the goby (*Sufflogobius bibarbatus*) in the Benguela ecosystem. *Journal of Applied Ichthyology* 26: 110-112.

Brüchert V, Currie B, Peard K.P.
2009 Hydrogen sulphide and methane emissions on the central Namibian shelf. *Progress in Oceanography* 83: 169-179.

Cedras, R.B., Veia Salvanes, A-G. and Gibbons, M.J.
(in review) Studies on the diet and feeding ecology of the bearded goby, *Sufflogobius bibarbatus*, off Namibia: implications for future research directions in the region? *African Journal of Marine Science*

van der Bank, M.G., Utne-Palm, A.C., Pittman, K., Sweetman, A.K., Richoux, N.B., Brüchert, V. and Gibbons, M.J.
(in review) Dietary success of a "new" key fish in an overfished ecosystem: evidence from fatty acid and stable isotope signatures. *Marine Ecology Progress Series*

Salvanes AGV, Utne-Palm AC, Currie B, Braithwaite VA
(submitted) Behavioural and physiological adaptations of the bearded goby: a key fish species of the extreme environment of Benguela. *Marine Ecology Progress Series*

Hundt, M., Utne-Palm, A.C. and Gibbons, M.J.
(submitted) Cross-shelf observations on the diet and diel feeding behaviour of the bearded goby, *Sufflogobius bibarbatus*, off Namibia. *African Journal of Marine Science*

Kaartvedt, S., Klevjer, T.A., Aksnes, D.L.
(submitted) Internal wave shading causes high frequency migrations in fish.

Neethling, S., Channing, A. and Gibbons, M.J.
(in preparation) Re-descriptions of *Chrysaora* (Semaestomeae: Pelagiidae) in the northern Benguela ecosystem: out with the new and in with the old. *ZooTaxa M.Sc. Thesis*

Cedras, R.B.
2010 The diet and feeding ecology of the pelagic goby, *Sufflogobius bibarbatus*, off Namibia. M.Sc. Thesis, University of the Western Cape.

Characterization of the *Mycobacterium tuberculosis* phosphorylome and its role in pathogenesis

Responsible University/Institution, Norway:

Det medisinsk-odontologiske fakultet, Universitetet i Bergen

Principal Investigator, Norway:

Wiker, Harald G. Professor

Prosjektnr: 180330/S50

Financed by RCN (in NOK):

1.4.2007-31.3.2010

2007: **218,500** 2008: **270,000** 2009: **261,000** 2010: **50,000**

Principal Investigator, South Africa:

Warren, Robin Mark

Financed by NRF (in ZAR):

2007: **212, 300** 2008: **287, 100** 2009: **436, 200** 2010: **56, 100**

Original project summary

Tuberculosis (TB) remains a major global public health concern. Approximately 2 million people die per year from TB, with South East Asia, Sub-Saharan Africa and Eastern Europe showing the highest levels of new cases and deaths. South Africa is one of the countries with the highest number of TB cases per capita. Recent advances in TB research have shown that the global TB epidemic is caused by many different variants of the causative agent *Mycobacterium tuberculosis*. Furthermore, research suggests that the properties of the different types of *M. tuberculosis* may have changed. These new forms of *M. tuberculosis* may be able to spread more rapidly, cause more disease, evade the effects of vaccination or reinfect individuals who have had a previous episode of TB. However, despite these advances in our understanding, the mechanisms underlying these different forms of *M. tuberculosis* remain to be determined. In this study we aim to determine whether the different forms of *M. tuberculosis* are caused by differences in the way proteins are modified. To our knowledge no study has been done to measure which of the *M. tuberculosis* proteins are modified and how this modification could change the proteins function. Furthermore it is not known whether the patterns of modification will change during different growth phases, during nutrient starvation, during hypoxia, and whether these patterns of modification will differ between the different forms of *M. tuberculosis*. Changes in the patterns of protein modification may provide novel insights into mechanisms regulating

bacterial growth. Such information may enable the identification of pathways regulating latent infection, pathogenicity and virulence. These modified proteins will be important targets for the designs of novel anti-tuberculosis drugs and may be candidates for the design of new anti-tuberculosis vaccines.

A popular-science presentation of results that have emerged during the project period is to be provided. Has this been done? Yes

Summary of main results

To date, whole cell lysate proteins, membrane proteins and culture filtrate proteins have been successfully extracted from:

- 1) The HypoSAWC507 and HyperSAWC5527 virulent Beijing genotype strains.
- 2) Four strains demonstrating different levels of drug-resistance.

In addition cultures representing 10 different *M. tuberculosis* evolutionary lineages have been cultured and whole cell lysate proteins, membrane proteins and culture filtrate proteins have been successfully extracted.

Mass spectrometry (LTQ-Orbitrap) was used to analyse the proteomes of two closely related Beijing genotype strains, HypoSAWC507 virulent and HyperSAWC5527 virulent strains, selected from an epidemiological reference bank representing an epidemiological window of 12 years from an epidemiological field site

near Cape Town, South Africa. A manuscript describing protein abundance in hypoSAWC507 virulent and HyperSAWC5527 virulent strains has been accepted for publication: de Souza GA, Fortuin S, Aguilar D, Pando RH, McEvoy CR, van Helden PD, Koehler CJ, Thiede B, Warren RM, Wiker HG. Using a label-free proteomic method to identify differentially abundant proteins in closely related hypo- and hyper-virulent clinical Mycobacterium tuberculosis Beijing isolates. *Mol Cell Proteomics* 2010. This is the first study to document changes in abundance of proteins which could explain the different epidemiological behaviour of these two strains. Furthermore, this is the first study to simultaneously measure the presence of 1443 proteins in the the HypoSAWC507 - virulent strain and 1524 proteins HyperSAWC5527 -virulent strain. These results also identified several transcriptional regulators that might be involved in virulence.

A second manuscript has also been submitted using the proteomic data generated for the hypoSAWC507 virulent and HyperSAWC5527 virulent strains. GA de Souza, MØ Arntzen, S Fortuin, AC Schürch, H Målen, CRE McEvoy, D van Soolingen, B Thiede, RM. Warren HG Wiker. Proteogenomic analysis of polymorphisms and gene annotation divergences in prokaryotes using a clustered mass spectrometry-friendly database. This manuscript reports the correlation between DNA sequence annotation and actual protein sequences. A total of 2561 different proteins were identified, of which 24 were present in *M. tuberculosis* H37Rv samples, but not annotated in the *M. tuberculosis* H37Rv genome. This analysis also enabled the identification of 280 non-synonymous single amino acid polymorphisms (SAP) and confirmed 367 translational start sites. As a proof of concept we applied the database to whole-genome DNA sequencing data of one of the clinical isolates which allowed the validation of 116 predicted SAPs and the annotation of 131 N-terminal start sites. Moreover, this study identified regions not present in the original *M. tuberculosis* H37Rv sequence, indicating strain

divergence or errors in the reference sequence. In conclusion, this study demonstrated the potential of using a merged database to better characterize laboratory or clinical bacterial strains. Numerous approaches to enrich phosphorylated proteins have been followed. Immunoprecipitation using a commercial kit (Qiagen-PhosphoProtein Purification kit) was unsuccessful. Subsequently, Titanium dioxide was used for the enrichment of phosphorylated peptides. However, initial experiments failed to identify phosphorylation possibly due to the instability of the post translational modification. On advice from numerous laboratories these experiments have been repeated under strictly controlled temperatures leading to the identification of 4 phosphorylated proteins (TatA: probable sec-independent protein translocase membrane-bound protein TATA; GarA: conserved hypothetical protein with FHA domain; Rv2536: probable conserved transmembrane protein; Rv0007: possible conserved membrane protein). These experiments are currently being repeated with freshly extracted proteins (whole cell lysate proteins, membrane proteins and culture filtrate proteins). Membrane proteins from the hypo-virulent and hyper-virulent Beijing strains have been fractionated by one-dimensional polyacrylamide gel electrophoresis and in-gel digested with trypsin. The resulting peptides have been purified and subjected to Mass Spectrometry in Oxford (UK) using the most recently developed, LTQ Orbitrap. The Mass Spectrometry data is currently being analyzed in conjunction with Prof Wiker and Dr de Souza. Preliminary analyses demonstrate the identification of approximately 2500 proteins per experiment. This is a significant increase in the sensitivity of the method allowing for an accurate determination of the structure of the cell walls of the hypoSAWC507 virulent and HyperSAWC5527 virulent strains. It is envisaged that these findings will be submitted for peer review and publication in the second half of 2010. (These data were accepted in "Molecular & Cellular Proteomics" and published as Epub 2010 Oct 28.)

Main publications:

Gustavo A. de Souza, Suereta Fortuin, Diana Aguilar, Rogelio Hernandez Pando, Christopher R. E. McEvoy, Paul D. van Helden, Christian J. Koehler, Bernd Thiede, Robin M. Warren and Harald G. Wiker.

2010 Using a label-free proteomic method to identify differentially abundant proteins in closely related hypo- and hyper-virulent clinical Mycobacterium tuberculosis Beijing isolates. <http://www.mcponline.org/content/early/2010/03/01/mcp.M900422-MCP200.long>. Mol Cell Proteomics 2010 (Epub ahead of print)

GA de Souza, Mø Arntzen, S Fortuin, AC Schürch, H Målen, CRE McEvoy, D van Soolingen, B Thiede, RM. Warren HG Wiker
Proteogenomic analysis of polymorphisms and gene annotation divergences in prokaryotes using a clustered mass spectrometry-friendly database. Submitted for peer review.

Degrees awarded to students attached to the project:

-

Integrated Health Information Systems for Public Health in South Africa

Responsible University/Institution, Norway :

Det matematisk-naturvitenskapelige fakultet, Universitetet i Oslo

Principal Investigator, Norway :

Braa, Jørn Førsteamanuensis

Project no: 180336/S50

Financed by RCN (in NOK) :

1.4.2007-31.3.2010

2007: **200,000** 2008: **200,000** 2009: **200,000**

Responsible University/Institution, South Africa:

University of Western Cape

Principal Investigator, South Africa:

Sanders, David

Financed by NRF(in ZAR):

2007: **400,000** 2008: **400,000** 2009: **400,000**

2007: 289,774 2008: 629,400 2009: 230,255 2010: 229,514

Original project summary

This is a proposal for a multi-disciplinary research project involving the academic fields of public health and informatics that will link two universities in South Africa (University of Pretoria, Department of Informatics, and the University of Western Cape, School of Public Health), and the Department of Informatics at the University of Oslo, Norway. The interdisciplinary nature of this consortium is highly relevant to address research in two areas of health management information systems that are highly relevant in the current South African context, namely the integration of information systems across functional areas (e.g. integration of vertical programs such as nutrition and HIV/AIDS), and the integration of different types of data, namely: patient based data, statistical routine data and routine survey data (such as a waiting times and efficiency survey) in a single system.

We address three areas identified in the call for proposals, namely the health and medical sciences (with emphasis on mother and child health, public and community based health, preventative health and nutrition), HIV/AIDS (including non-clinical and multi-sectoral perspectives), and information and communication technology.

We propose two hypotheses, firstly that effective information systems (IS) and systematic use of information, and

pragmatic perspectives on implementation of information systems will significantly increase quality, equity and accessibility of services. Secondly, that better integration of HIS across vertical programs and incorporation of routine surveys will significantly enhance the overall information system and the information available for each program. An action research methodology is proposed. An important consideration is the fact that the consortium already has a proven track record of experience and existing networks in the countries mentioned, and will thus quickly be able to scale up initiatives in support of the research agenda.

Summary of main results

The NRF/NFR project on the development of integrated health information systems in South Africa represented a continuation of the research collaboration between South Africa and Norway within the Health Information Systems Program - HISP - which started in 1994. The open source DHIS software developed first by HISP in South Africa, is now implemented in a large number of countries in Africa and Asia, and is also being adopted by the WHO. The current project has been engaged in developing and integrating HIV/AIDS system within the DHIS framework. The patient management and clinical data system for HIV/AIDS patients developed monitors lifelong ARV therapy. Results of this work is

also being implemented in Sierra Leone. The DHIS represent the platform with which integration of the HIV/AIDS system is carried out. A Waiting Times and Service Efficiency Survey was devised to be used for primary care clinics, secondary hospitals and tertiary hospitals. A robust methodology which is valid for primary level services and which also suits the complex way in which services are provided in secondary and tertiary hospitals was devised. Surveys were

conducted at facilities representing all three levels of care. One PhD student in the project defended his thesis on development of hospital information systems in 2009. His thesis shows that the socio-technical design of hospital management information systems needs to incorporate flexibility into all components of the system, from the paper based data collection tools to the software. Modularization is used to achieve this.

Main publications

Vincent Shaw

A complexity inspired approach to co-evolutionary hospital management information systems development, University of Oslo, Series of dissertations submitted to the Faculty of 905 Oslo

Reagon, G., Abie, Z., Adams G.

2007 Large Scale Routine Surveys of Waiting and Service Times Health Systems Trust Conf. SA, Oct. 2007

Selaolo, T.

2007 An Activity Theory based framework for enhancing of User 'Conscious' Learning in IS Development ICIS conference August 2007

Reagon, Igumbor, Koopman

2009 Assessment of waiting times at tertiary level health care facilities 5th ann. conf. of Public Health Ass, SA, Dec 2009

Reagon, Igumbor, Zogoe, Koopman, Adams, Titus

2008 Decrease in waiting times and improvement in quality of care due to routine waiting time an 4th Ann. Conf. of Public Health Ass. of SA,

V Shaw, C Simoonga, P Kalinda,

2008 Using Communities of Practice as a Lens for Understanding Adoption of ICT IST-Africa

Degrees awarded to students attached to the project:

Vincent Shaw

PhD

University of Oslo

M. Mavuso

Master of Public Health

University of Western Cape

K. Membo

Master of Family Medicine

University of Pretoria

O. Akerele

Master of Family Medicine

University of Pretoria

E. Ozah

Master of Family Medicine

University of Pretoria

Analysis and Possibility for Control of Atmospheric Boundary Layer Processes to Facilitate Adaptation to Environmental Changes

Responsible University/Institution, Norway:
Nansen Senter for Fjernmåling, Stiftelsen

Principal Investigator, Norway:

Ezau, Igor Postdoktorstipendiat

Prosjektnr: 180343/S50

Financed by RCN (in NOK):

1.9.2007-31.3.2010

2007: **105,000** 2008: **314,000** 2009: **294,000** 2010: **46,000**

Principal Investigator, South Africa:

Djolv, George

Financed by NRF (in ZAR):

2007: **141,091** 2008: **105,240** 2009: **178,752** 2010: **508,915**

Original project summary

Convective rainfalls are of enormous importance for agriculture and water resource management in semi-arid areas such as Central-North-Eastern South Africa, where more than 50% of the country population is concentrated. This project will contribute into the redress and capacity development of the South African Universities in the area of micro-meteorology and adaptation to changing environment such as climate change or urbanization. This redress will be achieved through promotion of micro-meteorological education and research on the basis of the most recent advances in the theoretical understanding (non-local and roughness turbulence theories) and numerical modelling (large-eddy and non-hydrostatic simulations). The main beneficiaries will be historically disadvantaged and indigenes. The project will give to their representatives the necessarily knowledge, field equipment and inexpensive numerical tools to rational landscape planning to support sustainable agricultural and air quality management. Impossible without extensive collaboration, the project will link established international consortiums driving all necessarily research components and lead them to attack the convection and rainfall problem successfully. An absolutely novel, and thus risky, element of the project, is a study of possibility to control the micro-meteorological processes through rational landscape management. In the case of success, it may bring major benefits to humanity, in the third world where other means to improve environmental conditions could be too costly.

Summary of main results

The project aimed to proliferate the state-of-the-art computational technology (the large-eddy simulation technique), new approaches to observations (micro-meteorological field experiment) and data processing (multi-factor regression) taken in combination and applied to studies of the planetary boundary layer over heterogeneous surface of the Highveld agricultural and mining region. The project objectives are:

- O1. To improve knowledge of the complex turbulent processes in the atmospheric boundary layer over heterogeneous landscapes and how these processes contributes to formation of convective weather systems and summer rainfall;
- O2. To investigate a possibility to control the turbulent processes and rainfalls through rational landscape design and changes of surface roughness;
- O3. To educate environmental students to use the turbulent process self-organization in planning for sustainable and inexpensive water and air quality management.

Account of the results achieved under the project in the context of the objectives
Towards O1, the project partners purchased 6 meteorological stations DAVIS VANTAGE PRO-II equipped with temperature, humidity, wind, precipitation and radiation sensors arranged for gradient measurements. One station has been used at University of Pretoria to educate meteorological students, 5 stations have been deployed in the Highveld region near city of Betha.

At present, more than 2 years of data have been collected and stored at NERSC and UP. The gaps and biases in the data require careful

post-processing. Therefore only about 2 months of data has been prepared for analysis. The stations are now relocated to another place in Kruger National Park to continue to provide data for another project driven by University of Pretoria following the tried approach.

The simulations (added with larger set of simulations at NERSC) revealed strong secondary circulations over heterogeneous surface. Following meteorological literature, the circulations were attributed to the self-organization of the boundary layer convective turbulence with emergence of largescale long-lived eddies comprising the entire boundary layer.

We found links between the surface types and eddies represented through consistent horizontal heat and moisture transport in the model. Following the modelling results, the data have been searched for similar signatures of the horizontal transport. We found the consistent pattern of relative differences in the temperature and moisture signals.

We looked for the rapid temperature transition events in the data that would correspond to the collapse of the nocturnal turbulent exchange with consequences to air quality and fog formation. Such events predicted by the bifurcation analysis but have not been found in African data before.

Towards O2, the project work was focussed on processes responsible for advection of the atmospheric moisture (led by University of Pretoria) and local coupling with the boundary layer convection (led by NERSC). Work has resulted into assembling of a broad multi-national consortium coordinated by NERSC (European partners) and UP (African partners) in the EU FP7 THEME 6 proposal EWA . However, the overall progress towards O2, has been below expectations due to difficulties to find and then to involve sufficiently qualified staff in South Africa.

Towards O3, the project contributed toward modernisation of the registered Course on the Boundary Layer Meteorology WKD719. The materials of this course, including the ported version of the code LESNIC, examples of calculations and statistical analysis, and manuals, were prepared and distributed on flash-drives. To raise the public awareness, the project participants lectured in ESCOM, Johannesburg City Council, Northwest University, Biodiversity Institute. The project has culminated with the Focussed International Conference on Planetary Boundary Layers and Climate Change 26 - 28 October 2009, Kirstenbosch Botanical Gardens, Cape Town

Main publications

- Zilitinkevich, S.S., I. Esau, N. Kleerorin and I. R
 On the velocity gradient in the stably stratified sheared flows. Part 1: Asymptotic analysis and app Boundary-Layer Meteorology, accepted for publication
- Zilitinkevich, S.S., and I. Esau
 2010 Planetary boundary layer feedbacks in climate system and triggering global warming in the night, in Geography, Environment and Sustainability, 01.okt jan.10
- Esau, I.
 2009 Comment on "Do stable atmospheric layers exist?" by S. Lovejoy et al. L11811 36/2009
- Idowu, O.S. and Rautenbach, C.J.deW.
 Model Output Statistics to improve severe storms prediction over Western Sahel
 Atmospheric Research, 419-425, 93

Degrees awarded to students attached to the project:

Marisa Nikola (UP)	MSc	In progress
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Industrial Applications of Metal Hydrides for Hydrogen Extraction, Storage and Compression

Responsible University/Institution, Norway:

Institutt for energiteknikk - Kjeller

Principal Investigator, Norway:

Yartys, Volodymyr A. Professor 2

Prosjektnr: 180344/S50

Financed by RCN (in NOK):

1.4.2007-30.9.2010

2007: **192,500** 2008: **192,500** 2009: **128,333** 2010: **164,167**

Responsible University/Institution, South Africa:

University of Western Cape

Principal Investigator, South Africa:

Linkow, Vladimir

Financed by NRF (in ZAR):

2007: **176,280** 2008: **235,559** 2009: **247,896** 2010: **321,084**

Original project summary

Introducing hydrogen as universal environment-friendly energy carrier demands efficient technologies allowing to extract it from industrial streams (products of coal gasification, process gases of refineries, etc.), to store it by a compact and safe way, and, finally, to deliver H₂ to a consumer at high pressure. Metal hydride (MH) technology is a promising solution. However, its implementation requires new MH materials whose performances are not deteriorated in contaminated H₂. In addition, novel engineering solutions incorporating the materials into H extraction-purification-storage-compression system are in great demand.

This proposal is focused on the detailed study of advanced "low-temperature" H storage alloys (RE-containing AB₅; and Ti-containing AB and AB₂) and multiphase compositions on their basis. Nanotechnological routes, including reactive mechanical alloying and forming the MH-carbon nanocomposites will be worked-out. Special attention will be paid to surface modification of the materials including deposition of thin metal films onto their particles, dosed surface oxidation and/or creation of oxide-modified hydride forming constituent phases. As a result, the MH materials characterised by high "poisoning" resistance, easy activation and fast H sorption / desorption kinetics will be developed. Furthermore, the experimental prototype of combined MH system for H₂ extraction/purification, storage and compression will be developed, including H₂ extraction/purification subsystem, H storage unit, as well as efficient MH H₂ compressor.

The work will combine the best efforts of the R&D communities in MH technologies including universities and academic institutions (IFE and NTNU in Norway; UWC in South Africa) and important industrial partners including Eskom (SA). 2 PhD students from SA will be educated.

Summary of main results

The collaborative activities within the project allowed to strengthen the competence of NO and SA R&D communities within the field of hydrogen-based metal hydride technologies to be implemented in the environment friendly hydrogen energy systems where a large global industrial market demand is evidently foreseeable.

The project strongly contributed to build scientific competence in the area of studies by educating two SA PhDs by their training and common research at the top-level potential of Norwegian institutions, IFE and NTNU).

Within the project there were developed novel materials and engineering solutions for hydrogen extraction from industrial gas streams, its compact and safe storage and easy in operation supply to a consumer. There were proposed novel approaches of utilisation of SA resources of noble metals (incl. Pd) in high technologies. The developments will be very useful for the collaborating with academia industrial partners in both Norway and South Africa. The results were extensively published in the international peer refereed scientific journals, presented at international symposia and conferences in the field, including invited presentations.

Main publications:

- Williams M, Nechaev AN, Lototsky MV, Yartys VA, Solberg JK, Denys RV, Pineda C, Li Q, Linkov VM.
2009 Influence of Aminosilane Surface Functionalization of Rare Earth Hydride-Forming Alloys on Palladium Treatment by Electroless Deposition and Hydrogen Sorption Kinetics of Composite Materials. *Materials Chemistry and Physics*, 2009, 115 (1): 136- 141
- Lototsky M.V., Denys R.V., Yartys V.A.
2009 Combustion-type hydrogenation of nanostructured Mg-based composites for hydrogen storage. *Int. J. Energy Research*, 2009, 33 (13): 1114-1125
- Williams M., Lototsky M.V., Linkov V.M., Nechaev A.N., Solberg J.K., Yartys V.A.
2009 Nanostructured surface coatings for the improvement of AB5-type hydrogen storage intermetallics. *Int. J. Energy Research*, 2009, 33 (13): 1171-1179
- Denys R.V., Riabov A.B., Maehlen J.P., Lototsky M.V., Solberg J.K., Yartys V.A.
2009 In situ synchrotron X-ray diffraction studies of hydrogen desorption and absorption properties of Mg and Mg–Mm–Ni after reactive ball milling in hydrogen, *Acta Materialia* 57 (2009) 3989–4000
- Lototsky M.V., Williams M., Yartys V.A., Klochko Ye.V., Linkov V.M.
2010 Surface-modified advanced hydrogen storage alloys for hydrogen separation and purification, *Journal of Alloys and Compounds* (2010), doi:10.1016/j.jallcom.2010.09.206
- Williams M., Lototsky M., Nechaev A., Yartys V., Solberg J.K., Denys R.V., Linkov V.M.
2010 Palladium mixed-metal surface-modified AB5-type intermetallics enhance hydrogen sorption kinetics, *South African Journal of Science* 106 (9/10) (2010), doi:10.4102/ sajs. v106i9/10.310
- Williams M., Lototsky M.V., Davids M.W., Linkov V., Yartys V.A., Solberg J.K.
2010 Chemical surface modification for the improvement of the hydrogenation kinetics and poisoning resistance of TiFe. *Journal of Alloys and Compounds* (2010)
- Wu Y., Lototsky M.V., Solberg J.K., Yartys V. A.
2010 Microstructural evolution and improved hydrogenation- dehydrogenation kinetics of nanostructured melt-spun Mg-Ni-Mm alloys. *Journal of Alloys and Compounds* (2010)
- Williams M., Lototsky M.V., Yartys V.A., Solberg J.K.
2010 Surface morphology and hydrogen sorption kinetics of rare earth AB5-type alloy surface-modified by acidic leaching and palladium autocatalytic deposition. *International Journal of Hydrogen Energy* (2010)

Degrees awarded to students attached to the project:

Kubefu Albert Maduna	BSc Honours	University of the Western Cape
Mario Williams	PhD	University of the Western Cape

Prospecting probiotics and antimicrobials in indigenous fermented milks for improved health

Responsible University/Institution, Norway:

Universitetet for miljø- og biovitenskap

Principal Investigator, Norway:

Narvhus, Judith A. Førsteamanuensis

Prosjektnr: 180345/S50

Financed by RCN (in NOK):

1.4.2007-30.9.2010

2007: **147,000** 2008: **251,000** 2009: **246,000** 2010: **79,000**

Responsible University/Institution, South Africa:

University of Western Cape

Principal Investigator, South Africa:

Viljoen, Benny

Financed by NRF (in ZAR):

2007: **263, 428** 2008: **299, 294** 2009: **373, 718** 2010: **438, 049**

Original project summary

The project will study various aspects of health-promoting organisms in indigenous fermented milk. Some probiotic lactic acid bacteria have great potential in the preparation of functional foods. Their potential health benefits include protection against infections caused by diarrhoeagenic microorganisms, use as an oral adjuvant and immunopotentiator in malnutrition. Their protective role may also be the result of competition with potentially harmful microorganisms. Additional health benefits include alleviation of problems of lactose intolerance in humans, increasing the peristaltic movement of parts of the digestive system, prevention and/or treatment of rotavirus and antibiotic induced diarrhoea, reduction in serum cholesterol, and reduction in hypertension. Many LAB also produce antimicrobial compounds (e.g. nisin) which can inhibit the growth of spoilage and/or pathogenic microorganisms in food, this providing a natural conservation of the food and protection of the consumer.

Selected microorganisms previously isolated and characterized during our collaborative program 200 which exhibit unique biochemical attributes as desired for specific applications in milk fermentations will be incorporated as starter cultures and probiotic agents. As these species are shown to have antagonistic effects against undesired pathogens and contaminants, they will be applied to promote health, and secure safe products for the communities. Positive species will be incorporated in scale-up methodology.

These novel ideas can also be applied to related industries, small scale farmers, communities in the rural areas and entrepreneurs in the implementation of new protective starter cultures and probiotics in fermented milk to improve present safety standards associated with the production and processing of the milk. The significance of the study will be due to promotion of safe and wholesome products with extended shelf-life, based on indigenous food technology.

Summary of main results

Lactic acid bacteria (LAB) and yeasts have been isolated from samples of indigenous fermented milk from several countries in Southern Africa. The LAB strains have been tested for potential probiotic properties and several strains showed the potential to survive the transit to the intestine by use of in vitro testing. However, some of the species (Enterococci) found were considered not suitable for human consumption, despite being LAB (MSc, completed). The LAB have also been shown to produce antimicrobial substances (bacteriocins), some of them against yeasts. This work is not yet complete due to changes at the Department in UFS. The lab isolates have been shown to interact with yeasts when grown in co-culture, in milk (MSc, completed). The inhibition of selected pathogens has also been documented and was found to be disappointing. The reason for this may be the slow fermentation that is typical of natural contamination of LAB in rather small numbers. The yeast isolates have

been characterised and also tested (still ongoing, MSc, SA) for their sensitivity to a new disinfectant compound. Interactions between LAB and yeasts within the actual products have been tested (still ongoing, MSc (SA)) using molecular techniques for studying microbial populations as well as classical culture techniques. The growth of species of

yeasts in cheese, and the effect on metabolites has also been studied (MSc, UFS, ongoing) and chemical, chromatographic analyses of the cheeses were done at UMB. Yeasts and LABs isolated from fermented milk in Swaziland was studied with respect to their growth in UHT milk and some interesting interactions were found.

Main publications:

Mufandaedza, J., Viljoen, B.C., Feresu, S.B. and Gadaga, T.H.

2006 Antimicrobial properties of lactic acid bacteria and yeast-LAB cultures isolated from traditional fermented milk against pathogenic *E. coli* and *Salmonella enteritidis* strains. *Int J Food Microbiol.* 108: 147 – 152.

Viljoen, B.C. and Uys, L..

2006 Probiotics as functional food – the beneficial claims. *Agro FOOD Industry High-tech* 17: 14–16.

Gadaga, T.H., Viljoen, B.C. and Narvhus, J.A.

2007 Volatile organic compounds in naturally fermented milk and milk fermented using yeast -lactic acid bacteria starter cultures. *Food Technology and Biotechnology* 45: 195 - 200.

Kebede, A., Viljoen, B.C., Gadaga, T.H., Narvhus, J.A. and Lourens-Hattingh, A.

2007 The effect of incubation temperature on the survival and growth of yeasts in Sethemi, South African naturally fermented milk. *Food Technology and Biotechnology* 45(1): 21 –26.

Kebede, A., B.C. Viljoen , T.H. Gadaga, J.A. Narvhus, A. Lourens-Hattingh.

2007 The effect of container type on the growth of yeast and lactic acid bacteria during production of Sethemi, South African spontaneously fermented milk. *Food Res Internat.* 40: 33 – 38.

Degrees awarded to students attached to the project:

J. Katongole	MSc	UFS
Pudumo	MSc	UFS
Lefoka	MSc	UFS
Solveig Ouren	MSc	UMB
Tonje Warholm	MSc	UMB
Birthe Enstad	MSc	UMB
Ingrid Evenstad	MSc	UMB

A Translational Effort to Develop Novel Magnetic Resonance Imaging Protocols and Sequences for Studying Myocardial Lethal Reperfusion Injury

Responsible University/Institution, Norway:

Det medisinsk-odontologiske fakultet, Universitetet i Bergen

Principal Investigator, Norway:

Jonassen, Anne Kristine Førsteamanuensis

Prosjektnr: 180347/S50

Bevilgningsperiode og finansiering fra Norges forskningsråd:

1.4.2007-31.3.2010

2007: **250,000** 2008: **170,000** 2009: **286,300** 2010: **82,100**

Responsible University/Institution, South Africa:

University of Western Cape

Principal Investigator, South Africa:

Meintjes, Ernesta

Financed by NRF:

2007: - 2008: **58, 761** 2009: **660, 116** 2010: **561, 522**

Original project summary

Cardiovascular disease remains a leading cause of death worldwide. Impaired coronary circulation in the heart following a myocardial ischemic episode will lead to compromised hemodynamic function and ultimately cell death. Coronary reperfusion is the only means of limiting infarct size, provided that it occurs early after coronary occlusion, but may paradoxically directly result in tissue injury (lethal reperfusion injury). The management of patients with acute myocardial infarction (AMI) has improved dramatically with the widespread use of thrombolytic and antiplatelet therapy as well as mechanical disruption of the occlusive coronary thrombus or plaque. Even so, attention has turned to adjunctive pharmacologic treatments to enhance myocardial tolerance to ischemia/reperfusion induced stress. This strategy is being pursued in an attempt to further reduce mortality in patients undergoing reperfusion therapy. This project is part of a translational effort dedicated to the development of new therapeutic protocols for the identification and validation of novel therapeutic targets in the treatment of acute myocardial ischemia (AMI) and reperfusion injury, in addition to development of novel MRI imaging protocols and sequences to be used in both clinical and experimental settings. The project will utilize state-of-the-art technologies in global gene expression analysis, retroviral vector RNAi technology, functional in vivo validation by inducible siRNA transgenic mouse model targeting candidate genes regulated by insulin therapy at

reperfusion, and cardiac magnetic resonance imaging. Overall, this research program will provide greater insight into the genetic mechanisms orchestrating insulin pro-survival effects, providing new targets for therapeutic intervention in the context of ischemia/reperfusion injury in patients and implementation of more advanced and sensitive MRI protocols and sequences for studying progression of AMI in patients.

Summary of main results

This project is a very ambitious project, where we combine basic experimental and clinical studies, with the development of new protocols and sequences for magnetic resonance imaging (MRI) to be used both in animal and human studies. The very nature of the project is based on method establishment both at the Norwegian and the South African side, which are time consuming processes. The current project put forward new knowledge in terms of signalling mechanisms that insulin activate at early reperfusion after a longer ischemic event, and may identify new targets for development of medication aimed at reducing the degree of lethal reperfusion in jury in the heart. Furthermore, it is evident from the results that it is possible to administer insulin as a single component intra-ventricular at the moment of ischemic-reperfusion in the in vivo rat heart, resulting in improved hemodynamic recovery and reduced infarct size, without deleterious effects on the level of glucose or potassium in the blood. The results also clearly show that it is safe to administer intracoronary

insulin in a pig PCI model mimicking the clinical treatment scenario, but the tolerated dosage of intracoronary administered insulin depends on the patients nutritional status (fasted versus feed). Another important aspect of applying insulin as a cardioprotectant in patients suffering from AMI, is the potential of lowering the treatment cost, as insulin is a relative inexpensive drug readily available in third world countries. Further, it is of vital importance in order to obtain reliable and accurate data, that the area at risk of infarction and the actual infarct size can be determined using the same measuring methodology. Since we used cardiac MRI as one of the endpoint measuring infarct size, we had to develop new methodology (Fe-microspheres) to determine area at risk also applying cMRI. Furthermore, the MRI results obtained in ZA were met with enthusiasm at the

recent Annual Meeting of the International Society of Magnetic Resonance in Medicine, indicating amongst others that it might be possible to reduce the MRI scanning time of cardiac patients from 40 to 20 min. When implemented in the clinic, reducing the scanning time for each patient will have clear economical ramifications for the hospital budgets. Furthermore, the research group at UCT is the only group doing basic MRI research in South Africa. Cardiac MRI is also technically challenging and skills in this area are severely lacking in South Africa. To date, the student involved in this project is one of 3 in the country with skills in this area. In order to continue this work initiative the collaborative partners of this project are in the process of applying for funding to continue the work initiated during this project period.

Main publications

Slettom G, Jonassen AK, Nordrehaug a.o.

Percutaneous Catheterbased Intracoronary Infusion of Insulin ? a Dose Finding Study in the Porcine M, Submitted JCardiovasc Pharmacol

Mykletun M, Aarnes EK, Breivik L, Jonassen AK

Insulin Therapy administered at ischemic-reperfusion reduces infarct size and improves hemodynamic r, Submitted BRC

Degrees awarded to students attached to the project:

Ian Burger
Neil Hendricks
Mira Mykletun

Upgraded from MSc to PhD (in progress)
Cardiology Trainee (to be compl. Jan. 2011)
MSc

University of Cape Town
University of Cape Town
University of Bergen

Springtail (Collembola) responses to changing, variable environments: a bi-polar approach linking individuals to ecosystems

Responsible University/Institution, Norway:

Det matematisk-naturvitenskapelige fakultet, Universitetet i Oslo

Principal Investigator, Norway:

Leinaas, Han Petter Professor

Prosjektnr: 180349/S50

Financed by RCN (in NOK):

1.4.2007-30.9.2010

2007: **171,800** 2008: **165,500** 2009: **175,000** 2010: **41,400**

Responsible University/Institution, South Africa:

Stellebosch university

Principal Investigator, South Africa:

Chown, Steven

Financed by NRF (in ZAR):

2007: **342, 631** 2008: - 2009: **608, 986** 2010: **98, 788**

Original project summary

The aim of this project is to investigate the way in which environmental variation cascades up through life history variation to effect species- and assemblage-level responses to habitat fragmentation and climate change. It builds on observations that climate change and habitat fragmentation are two major threats to biodiversity, and on recent work demonstrating that predictability and variability are two components of environmental variation that need to be clearly distinguished. The work will focus on a functionally significant group of soil animals, the springtails (Collembola), which are sufficiently circumscribed in their diversity to enable appropriate comparisons between different environments. Moreover, several of the species are common to virtually all of the sites owing to biological invasions in the southern hemisphere. The environments will include a southern sub-Antarctic site (Marion Island), a northern Arctic one (Svalbard), and two more temperate sites (in Scandinavia, and the Western Cape of South Africa). These sites differ substantially in the characteristics of their environments. The study will make use of both naturally (Marion, Svalbard) and artificially fragmented (Western Cape) landscapes to investigate the ways in which temperature effects on life histories might cascade up to influence responses to fragmentation. Specific goals of the study include investigations of widely held ideas about differences in phenology between the northern and southern

hemisphere arthropods, and about the likely responses of soil organisms to habitat fragmentation. The project will also develop an inventory of springtails of the Western Cape Fynbos and will use genetic techniques coupled with traditional morphological systematics to identify and describe new species and make this knowledge accessible more broadly to ecologists.

Summary of main results

The aim of the project was to investigate the way in which the effects of environmental variation on individual performance cascades up through complex assemblages of species and ecosystem processes. We focussed on springtails (Collembola), which has been identified as an important group of soil animals, through their role in decomposition processes. The studies have focussed on animals from a southern sub-Antarctic site (Marion Island), a northern Arctic one (Svalbard), and two more temperate sites (in Scandinavia, and the Western Cape of South Africa), which all differ substantially in the characteristics of their environments.

The northern species typically have distinct seasonal patterns with peak activity in summer. In Western Cape, in contrast, the main activity appears to occur during the humid winter, while the main challenge during summer is to survive. Consequently, although Western Cape is much

warmer than Scandinavia, the main period of springtail activity may not be very different, and could explain why many European species appears to have been successfully established there. At Marion Island, cool oceanic climate allows springtail activity all year round, and apparently also easily invaded by a number of European species.

At Marion Island, we focussed on the fact that the island has several invasive springtail species as well as a suite of indigenous ones. In springtails, important environmental stressors are desiccation exposure and to some extent extreme thermal conditions, while development rates are in general assumed to be closely linked to fitness, and thus may be an important aspect of a species' success. We showed surprisingly strong effect of thermal acclimation (to 5 and 15°C) on the ability to tolerate drought stress, with the invasive species becoming more tolerant and the indigenous less tolerant if being acclimated to the highest temperature. The invasive species also were more tolerant to higher temperature, but equally tolerant to low temperatures, and they had significantly higher development rates across temperatures. These differences are consistent with the successfulness of these invasive species on some of the southern ocean islands, such as Marion Island, and strongly suggest that they may be even more invasive following forecast climate change, with higher temperatures and drier conditions in this area of the world. This may also increase the risk of more southern islands being suitable for invasion by the same species. One goal of the project was to study life history influences on responses to habitat fragmentation in the Western Cape Fynbos biome, and the relation between diversity of springtails and decomposition rates of litter from different plant species. Previous studies in the Fynbos have suggested that biological decomposition rates are so low that fire is the main factor contributing to litter breakdown and nutrient release. Our results suggest that biological decomposition has been

underestimated. Moreover, in one of our study-fields, belonging to the Renosterveld vegetation of the Fynbos, the springtail fauna was totally dominated by the invasive European species *Hypogastrura maubrialis*, which constituted about 70% of the total springtail number. The establishment of this population appeared highly dependent on litter from the bush *Galenia africana* where its density was an order of magnitude higher than in other litter. *G. africana* is usually not common in undisturbed, natural Renosterbos, but is an indicator species for heavy grazing. Thus, the increased dominance of *G. africana* following heavy grazing may not only promote invasion of a European species, but may also lead to substantial general negative consequences on the indigenous soil fauna, possibly as a result of negative interactions with *H. manubrialis*. In order to improve our knowledge about the largely unknown South African springtail fauna as a necessary background for our ecological work, we have also included project part combining morphological taxonomy and mtDNA COI barcoding work (together with Swedish, French and South African collaborators). We have now probably sampled more than hundred species new to South Africa and many of them are in fact new to science. From the results obtained so far, the taxonomists believe that the fauna of the Western Cape region may include about 400 species.

The projects have enabled us to provide systematic training to a Ph.D. student (Charlene Janion), ecological training to an Hons student (Amy Liu), and training to several students from the NEPAD region as a consequence of a co-funded workshop. Ms. Janion is now well on her way to becoming the only specialist on an ecologically exceptionally important group in South Africa. The projects have contributed, together with the South African - Sweden and the South African - France projects, to the establishment of the "Collembola of South Africa" website (www.collembola.org).

Main publications

Chown, S.L., Slabber, S., McGeoch, M.A., Janion, C., and Leinaas, H.P.
2007 Phenotypic plasticity mediates climate change responses among invasive and indigenous arthropods. *Proceedings of the Royal Society B* 274, 2531-2537.

Janion, C., Worland, M.R., Chown, S.L.
2009 Assemblage level variation in springtail lower lethal temperature: the role of invasive species on sub- antarctic Marion Island. *Physiological Entomology* 34, 284-291.

Leinaas, H.P., Slabber, S. & Chown, S.L.

2009 Effects of thermal acclimation on water loss rate and tolerance in the collembolan *Pogonognathellus flavescens*. *Physiological Entomology* 34, 325-332.

Worland, M.R., Janion, C., Treasure, A. & Chown, S.L.

2010 Pre-freeze mortality in three species of aphids from sub-Antarctic Marion Island. *Journal of Thermal Biology* 35, 255-262.

Janion, C., Leinaas, H.P., Terblanche, J.S. & Chown, S.L.

2010 Trait means and reaction norms: the consequences of climate change/invasion interactions at the organism level. *Evolutionary Ecology*, in press.

Bengtsson, J., Janion, C., Chown, S.L. & Leinaas, H.P.

2010 Variation in decomposition rates in the fynbos biome, South Africa: the role of plant species and plant stoichiometry. *Oecologia*, in press.

In preparation:

Bengtsson, J., Janion, C., Chown, S.L. & Leinaas, H.P.

Decomposition of single and mixed plant litters in South African fynbos. For *Soil Biology and Biochemistry* as first submission.

Leinaas, H.P., Janion, C., Bengtsson, J. & Chown, S.L.

Synergistic interactions between land use modification and invasion in the Renosterveld. For *Ecology Letters* as first submission.

Chown, S.L., Janion, C. & Leinaas, H.P.

Environmental variability as a factor influencing egg development rates in springtails from the Arctic and Antarctic regions. For *Functional Ecology* as first submission.

Degrees awarded to students attached to the project:

Janion Scheepers, C.

MSc

Stellenbosch University

Metagenomics and Gene Discovery in Antarctic Terrestrial Habitats

Responsible University/Institution, Norway:

Det matematisk-naturvitenskapelige fakultet, Universitetet i Bergen

Principal Investigator, Norway:

Birkeland, Nils-Kåre Professor

Prosjektnr: 180352/S50

Financed by RCN (in NOK):

1.4.2007-31.3.2010

2007: **118,500** 2008: **245,000** 2009: **265,000** 2010: **125,000**

Responsible University/Institution, South Africa:

University of the Western Cape

Principal Investigator, South Africa:

Cowan, Don Prof

Financed by NRF (in ZAR):

2007: **91, 211** 2008: **399, 445** 2009: **322, 242** 2010: **156, 272**

Original project summary

We aim to use metagenomic methods to access portions of Antarctic low temperature crenarchaeotal genomes. Large insert metagenomic fosmid clones identified by colony hybridization with crenarchaeotal 16S rRNA gene probes will be sequenced and ORFs identified. The design of probes to terminal regions of the positive clones can provide access to proximal sequences, allowing us to genome walk along the crenarchaeotal chromosome. Detailed bioinformatic analysis (particularly using COG databases) will allow us to infer the function of a proportion of the identified ORFs, from which we aim to derive information on physiological function. The long term aim of this project would be to use physiological information to guide the development of isolation strategies in order to access pure cultures of these recalcitrant organisms. Dr. Cowan's laboratory has a wide variety of source material from the Dry Valleys of Eastern Antarctica. These samples have been collected as part of an on-going research program on the diversity and function of microorganisms in the desert soils of the Antarctic Dry Valleys. Based on the metagenomic clones, we will also investigate the mechanisms of cold-adaptation of enzymes, using isocitrate dehydrogenase (IDH) as a model. This will shed light on how the organisms have adapted to the arctic environment. Furthermore, we intend to study the Cdc6 and MCM proteins from a variety of archaeal species identified in the libraries. This will broaden our knowledge about the mechanism of initiation of archaeal DNA replication. A comparative functional analysis as well as protein-protein and protein-DNA-

interactions of purified Cdc6 and MCM proteins encoded on identical cloned fragments will be carried out. This will include studies on how Cdc6 stimulates or inhibits the helicase activity of MCM, and how they physically interact with each other. Finally, functional analyses using homologous replication origins will be pursued.

Summary of main results

Antarctic terrestrial habitats constitute one of the most extreme environments on Earth. The desert soils of the Antarctic Dry Valleys are impacted by a combination of oligotrophy, extreme cold, wide thermal variations, desiccation and high UV radiation. A metagenomic approach (i.e. based on direct analysis of DNA without cultivation) have been used to analyse the microbial communities in these habitats through fosmid cloning, selection and identification of novel cold-adapted genes/enzymes and microbial community analyses. Clones showing esterase/lipase activity have been selected for complete 454 sequencing, which have yielded novel gene sequences encoding biotechnologically interesting cold-active enzymes. Clones that are able to enhance the growth of *E. coli* at 14 degrees C have been isolated and candidate "cold-adaptation" genes have been identified and will be the basis for further studies on cold-adaptation mechanisms.

High-throughput 454 sequencing of amplicons produced by PCR amplification of 16S rRNA genes has provided extensive and valuable data sets of the microbial community structures in hypolithic and open soil micro-habitats in the dry valleys. The results will provide insights into

the diversity and cold-adaptation of
psychrophiles in this environment and form the

basis for further exploration of this extreme
environment.

Main publications

Heath, C et al.

2009 Isolation and characterisation of a novel, low-temperature-active alkaliphilic esterase from an Antarctic desert soil metagenome. *App!. Environ. Microbio!.* 75:4657-4659

Degrees awarded to students attached to the project:

Dominique Anderson

MSc (March 2008)

UWC

Xiao-Ping Hu

Honours (March 2008)

UWC

Nutritional intervention and novel diagnostics to improve community-based control of tuberculosis

Responsible University/Institution, Norway:

Det medisinsk-odontologiske fakultet, Universitetet i Bergen

Principal Investigator, Norway:

Grewal, Harleen Professor

Prosjektnr: 180353/S50

Financed by RCN (in NOK):

1.4.2007-30.9.2010

2007: **61,000** 2008: **105,000** 2009: **26,000** 2010: **98,000**

Responsible University/Institution, South Africa:

University of the Western Cape

Principal Investigator, South Africa:

Swart, Rina Dr

Financed by NRF (in ZAR):

2007: **14, 264** 2008: **588, 544** 2009: **488, 146** 2010: **332, 085**

Original project summary

Tuberculosis (TB) is a major public health problem in developing countries as well as in the Republic of South Africa (RSA). Despite significant strides in case detection and treatment, the prevalence of TB continues to rise at an alarming, also in the RSA. More effective diagnostic methods are required as early diagnosis is the cornerstone of effective TB control. The inexpensive standard Mantoux skin test which is currently used to identify TB suffers from poor specificity and poor positive predictive value (PPV) because the antigens are present in environmental bacteria as well as in the BCG vaccine. The ESAT-6 antigens are specific for *Mycobacterium tuberculosis* (M.tb), the causative agent of TB. New blood-based in vitro IFN-gamma release assays (IGRAs), based on ESAT-6 antigens, are more specific than the Mantoux skin test and have shown to have enhanced sensitivity in diagnosing active TB disease in HIV-infected and malnourished HIV-infected children. We hereby propose to evaluate the diagnostic value and utility of the new ESAT-6-based IGRAs to detect M.tb infection and predict TB disease in HIV-infected and uninfected South African children.

TB drugs are often administered to malnourished individuals, despite the fact that specific micronutrient deficiencies may negatively affect drug kinetics, decrease their efficacy and increase their toxicity. A randomised controlled trial will assess the effect of adjunctive micronutrient supplementation, administered as part of the established Directly Observed Treatment

Short-course (DOTS), on treatment outcome among pulmonary TB patients. Depending on the magnitude and range of effects, the data from this trial could lead to national and international policy recommendations to include micronutrient supplementation as an adjunct to standard anti-TB treatment.

Summary of main results

The overriding goal of the studies described in this proposal is to contribute towards the community control of TB. There are limited data comparing Interferon-Gamma release assays (IGRAs) for the detection of *Mycobacterium tuberculosis* (M.tb) infection in highly endemic settings. A cross-sectional household contact study (Cape Town, South Africa) to measure the agreement of two IGRAs (QuantiFERON(R) TB Gold (QTF) and T SPOT.TB) in relation to the tuberculin skin test (TST) to detect M. tb infection and assess the influence of M.tb exposure and age was conducted. It was concluded that, the T SPOT.TB may be more sensitive than the TST or QTF to detect recent M. tb infection in children. We also show that the QTF assay is a robust and highly reproducible assay. Considerable intra-individual variability occurs in the magnitude of IFN-gamma responses, which may influence the interpretation of serial measures. Data of serial measures of M.tb infection and disease in the household contact study indicate a high risk of persistent infection following documented household TB exposure. Of key importance is the high incidence of active TB disease in children (~15%) enrolled in this TB household contact study,

emphasizing the relevance of the household contact design for studies investigating the prognostic utility of novel TB diagnostic tests.

Novel molecular genotyping techniques have revealed the presence of mixed M.tb infections, which may accelerate the emergence of drug-resistant strains. Mycobacterium tuberculosis isolates (43% multi-drug resistant) from eight of the nine provinces of South Africa were analyzed by spoligotyping and analysis of the mycobacterial interspersed repetitive units. For the most frequent genotypes observed; ST53 (11%) and ST1 (10%) isolates, we show that 54% of the ST53 isolates were of mixed M. tb subpopulations. Furthermore, by employing phenotypic and genotypic tests we show that a high proportion of South African multi-drug resistant (MDR) M.tb isolates are resistant to pyrazinamide, suggesting an evaluation of its role in patients treated previously for tuberculosis as well as its role in the treatment of MDR-TB.

TB drugs are often administered to malnourished individuals, despite the fact that specific micronutrient deficiencies may negatively affect drug kinetics, decrease their efficacy and increase their toxicity. We have in a randomised control trial conducted in Delft, South Africa, assessed the efficacy of vitamin A and zinc supplementation on sputum smear and culture conversion and time to culture detection (TTD) among new cases with pulmonary TB. Subjects were randomized to receive a single dose of 200 000 IU of retinyl palmitate or matching placebo within 24 hours

after the start of standard TB therapy. They also received 15 mg zinc or placebo daily for 8 weeks. We show that supplementation with vitamin A and zinc did not affect treatment outcomes of patients with pulmonary TB after 2 months (M. Visser et al. Am J Clin Nutr. 2011; 93(1):93-100).

Nested within this randomised control trial we have added on a study on population pharmacokinetics of rifampicin in South African TB patients, where project collaborators have found that the SLCO1B1rs419032 polymorphism exists at high frequency and results in a decreased (35%) bioavailability of rifampicin.

Finally, recent studies have highlighted the frequent isolation of several different M.tb strain lineages in single disease episodes, often with differing drug susceptibilities. However, our understanding of the nature and frequency of mixed infections is lacking. We investigated the frequency of mixed TB infections in the Delft region of the Western Cape, as part of a clinical trial on the effects of micronutrient supplementation together with standard TB treatment. We found, of the 27 patients harbouring mixed infections, sputum from 20 (74%) remained culture positive at week 8. The relatively high frequency of mixed infections in this area warrants further attention and may have implications with regard to the interpretation of epidemiological and DST data, and the subsequent treatment of patients (M. Stead; oral presentation at World Conference on Lung Health, Berlin 11-15 Nov. 2010).

Main publications

K. Du Preez, A.M. Mandalakas, H. L. Kirchner, H. M. S. Grewal, S. S. van Wyk, and A.C. Hesseling. 2010 Positive association and dose-response between environmental tobacco smoke exposure and tuberculosis infection in children. Submitted Paediatrics.

ME Visser, H.M.S. Grewal, EC Swart, M A Dhansay, G. Walzl, S. Swanevelder, C. Lombard and G. Maartens. 2010 Vitamin A and zinc supplementation and treatment outcome in pulmonary TB: a controlled trial. In press American Journal of Clinical Nutrition.

Hesseling AC, Gie RP, Mandalakas AM. 2009 The predictive value of the ELISpot-based interferon-gamma-release assay for tuberculosis disease. Ann Intern Med. 2009 Mar 17;150(6):428-9; author reply 429-30.

Marais BJ, Hesseling AC, Cotton MF. 2009 Poverty and tuberculosis: is it truly a simple inverse linear correlation? Eur Respir J. 2009 Apr;33(4):943-4

Detjen AK, Loebenberg L, Grewal HM, Stanley K, Gutschmidt A, Kruger C, Du Plessis N, Kidd M, Beyers N, Walzl G, Hesselning AC.

2009 Short-term reproducibility of a commercial interferon gamma release assay. *Clin Vaccine Immunol.* 2009 Aug;16(8):1170-5. Epub 2009 Jun 17.

Marais BJ, Hesselning AC, Schaaf HS, Gie RP, van Helden PD, Warren RM.

2009 *Mycobacterium tuberculosis* transmission is not related to household genotype in a setting of high endemicity. *J Clin Microbiol.* 2009 May;47(5):1338-43. Epub 2009 Mar 4.

R. Stavrum, M. Mphahlele, K. Øvreås, T. Muthivhi, K. Weyer, P. B. Fourie, and H. M. S. Grewal.

2009 High diversity of *Mycobacterium tuberculosis* genotypes in South Africa and preponderance of mixed infections among ST53 isolates. *J Clin Microbiol.* 2009 47(6):1848-56.

H. Syre, V. P. Myneedu, V. K. Arora, and H. M. S. Grewal.

2009 Detection of mycobacteria species directly in pulmonary specimens by rapid, amplification tests; the MTD and the GenoType Mycobacteria Direct tests. 2009. In press *J Clin Microbiol.*

Hesselning AC, Mandalakas AM, Kirchner et al.

2008 Highly discordant T-cell responses in individuals with recent household tuberculosis exposure. *Thorax.* 64(10):840-6. Epub 2008 Aug 5.

Mandalakas A M, A.C. Hesselning, N. Chegou, N. Beyers, G. Walzl et al

2008 High level of discordant IGRA results in HIV-infected adults and children In *J Tuberc Lung Dis.* 2008 Apr;12(4):417-23.

Grewal H. M. S., Gupta S, Singh S.

2008 Opportunistic pathogens in AIDS: trends, diagnosis and priorities. 2008. *Expert Rev Anti Infect Ther.* 6(2):163-6.

Mphahlele, M, H. Syre, H. Valvatne, R. Stavrum, T. Mannsåker, T. Muthivhi, K. Weyer, B. Fourie, and H. M. S. Grewal.

2008 Pyrazinamide resistance among South African multi-drug resistant *Mycobacterium tuberculosis* isolates. *J. Clin Microbiol.* 46:3459- 64.

H. Syre, A. C. Hesselning and H. M. S. Grewal.

2009 Advances in the laboratory diagnosis of tuberculosis. In: *Manual on TB, HIV and Lung Health;* (editor) V.K. Arora. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi. 2009: 251-265.

H. Syre and H. M. S. Grewal.

2009 Conventional and automatic detection of acid fast bacilli. In: *Manual on TB, HIV and Lung Health;* (editor) V.K. Arora. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi. 2009: 265-274.

Degrees awarded to students attached to the project:

Marianne E. Visser	PhD (to be submitted in March 2011)	University of Western Cape
Candice Lombardo	MPh (submission December 2010)	University of Western Cape
Laurianne Loebenberg	PhD (submitted October 2010)	Stellenbosch University
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ICT and poverty - a community-based user approach

Responsible University/Institution, Norway:
Norsk institutt for by- og regionforskning

Principal Investigator, Norway:

Braathen, Einar Forsker 2

Prosjektnr: 180354/S50

Bevilgningsperiode og finansiering fra Norges forskningsråd:

1.4.2007-30.9.2010

2007: **300,000** 2008: **300,000** 2009: **200,000** 2010: **122,600**

Responsible University/Institution, South Africa:

University of KwaZulu-Natal

Principal Investigator, South Africa:

May, Julian Douglas Prof

Financed by NRF:

2007: **413, 000** 2008: **473, 611** 2009: **456, 828** 2010: **161, 481**

Original project summary

The digital challenges ahead for a country like South Africa can be met with different types of action. So far the emphasis has been on increased fixed line and mobile telephony access for disadvantaged communities. There are two major concerns :

1. The efforts have been mainly carried out in supply-led and top down ways either by the government or market operators. 2. There has been no successful drive towards increased public access to computer use and internet.

The data will be collected with a quasi-experimental approach . Using similar quantitative and qualitative data gathering techniques, and a panel study design, the objective is to provide measurable evidence on the impact of ICTs on the reduction of poverty. The approach embodies 4 stages:

- I. A baseline study of selected groups in selected communities;
- II. A participatory learning process with the groups, resulting in the design of the subsequent (intervention) stage
- III. An intervention designed to accelerate the use of ICTs among groups in some of these communities which will be randomly selected as a 'treatment' group, while delaying the provision of this training by one year for the 'control' group;
- IV. An impact study - second wave of data collection. Impacts of the interventions on

digital poverty as well as of ICT usage on the wider dimensions of poverty will be analysed.

Summary of main results

The efforts during the first decade of post-apartheid South Africa to bridge the digital divide had no documented success. Previous research indicates that these efforts were carried out in supply-led and top down ways either by the government, e.g. through the set-up of multi-purpose telecentres, or by the main telephony operators. The project Community-based Learning, ICTs and Quality-of-life? (CLIQ) was set out to test the extent to which a more demand-led, participatory and skills-driven approach could make a difference. Four communities in rural and peri-urban Kwa-Zulu Natal with multi-purpose telecentres were invited to take part in the project. From May 2008 to May 2010, 227 individuals were interviewed and 145 were selected for participatory needs assessment and training. The project has shown that ICTs (particularly computers) can improve the well-being of poorer people living in under-resourced communities, if they are supported with needs-based training and use. For a larger policy scale, the challenge is to provide public technical and financial support in a flexible and cost-efficient manner.

Degrees awarded to students attached to the project:

Heidi Attwood

Research Masters in
Development Studies

In progress at UKZN

Jenny Schaanning

Masters thesis, April 2010

Department of Political Science, UiO