SIMRAC NEWSLETTER

Issue 3, 2000 October 2000 - January 2001

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SIMRAC Website Update - Susan Griffiths

Since July 2000, SIMRAC Project Support Services has maintained two Websites pertaining to the SIMRAC research cycle.

The sites have essentially two functions: The SIMPROSS site www.simpross.co.za is for access by SIMRAC committee members only. A password is required in order to retrieve minutes and documents archived for committee meetings. The SIMRAC site www.simrac.co.za houses the research reports and news about current SIMRAC activities.

The SIMRAC Website is currently undergoing a facelift. The aim of the exercise is to make the site user-friendlier. Re-referencing of files loaded prior to SIMPROSS hosting the site will make the site accessible for all browsers.

We have also made use of the services of *Google[sm] in order to add a keyword search facility to the site. This web-based search engine browses through the project summaries in order to match a search request. We will also be looking at ways of making a search facility available with SIMRAC CD's.

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3The SIMPROSS research manager and staff wish you a happy Christmas and a prosperous 2001.

*Google[sm] *was founded in 1998 by Larry Page and Sergey Brin, two Stanford Ph.D. candidates, who developed a technologically advanced method for finding information on the Internet.*

SIMRAC has highlighted technology transfer as one of the key areas for future focus. It is therefore important that the Website provides the user with current information on SIMRAC work. We intend to make use of different forms of media to further assist the end user in understanding key concepts of research.

There are currently 145 reports loaded on the SIMRAC Website, 70 of which will be distributed on the SIMRAC CD, Volume 2.

Website Statistics

Extreme Tracker, a free facility, has been added to the Website on 6 November 2000. In a review period of 18 days, the following information has come to light:

There were 157 visits over this period; the highest number of visits for one day was 23; and there were on average 8 visits per day.

Geographical breakdown of visitors

South Africa:	69.42%
Australia:	1.91%
Canada:	1.27%
United Kingdom:	0.63%
Unknown:	26.74% (These visitors have a .net address)

Recommendations for 2001

- The addition of a search engine facility that works on both an Internet and CD platform.
- The use of different media in order to enhance the end user's perception and understanding of SIMRAC research.
- A programme for ongoing site promotion needs to be in place. A suggested mechanism is the creation of SIMRAC e-news, an email listing which keeps interested parties informed of the electronic updates that have occurred in terms of technology transfer.
- SIMRAC programme managers need to make use of the Website as one means of the promotion of SIMRAC activities, research results and project launches.

For more information please contact the webmistress, Susan Griffiths, at sgriffiths@simpross.co.za or phone her at 27 11 358 9187

CALENDAR OF EVENTS

MEETINGS*

SIMRAC: 16 Feb. 2001; 27 Feb. 2001 (Convenors)
SIMCOM: 23 Jan. 2001; 8 Feb. 2001
SIMGAP: 19 Jan. 2001; 6 Feb. 2001
SIMHEALTH: 17 Jan. 2001; 7 Feb. 2001
SIMENG: To be scheduled
SIMROCK: To be scheduled
MANCOM: 2 Feb. 2001
* Subject to change

RESEARCH INPUT: 2002 PROGRAM

Research needs for the period 2002 will be considered as from February 2001.

All interested parties are invited to propose occupational health and safety research topics for this period.

More information can be obtained from the SIMRAC Research Manager, Paul van der Heever, at phone 27 11 358 9180 or by email at pvdheever@simpross.co.za

Life in extreme environments - Mary Ross

The Department of Microbiology at the University of the Orange Free State and the Department of Geosciences at Princeton University presented a fascinating workshop on Biotechnical Applications of Deep Surface Microbial Investigations in Bloemfontein in December 2000. Project management services in South Africa are provided by Turgis Technology (Pty. Ltd).

In 1996, members of the Princeton University group isolated a thermophilic iron reducing bacterium from a borehole in a South African gold mine at a depth of 3,2 kms below surface. Samples collected from other mines confirmed that the Witwatersrand basin contains "extremophile" microbial populations that may have novel applications in biomining.

The United States National Science Foundation and NASA have funded a further 5 year study through the "Life in Extreme Environments (LExEn) program" and the Bloemfontein workshop facilitated discussion of both the current knowledge and the possible U.S.A. - S.A. collaboration in research to improve the understanding of deep mine microbial populations and the potential applications.

Life in extreme environments -continued

Workshop participants were familiarised with the progress made in the Witwatersrand Deep Microbiology Project and the potential benefits of the LExEn research to the South African mining industry. A further important outcome was the further development of programmes for training South African scientists and technicians, particularly those from previously disadvantaged communities and universities.

Presentations were made by a variety of scientists with diverse backgrounds from North America, England and South Africa.

Dr T C Onstott of the Department of Geosciences at Princeton University reported work on aseptic coring and sampling techniques developed with mining engineers at East Driefontein. Chemical, molecular and isotopic fingerprints have been identified to discriminate "service" water from "dolomite" and "fissure" water. It is also possible to distinguish microbes associated with the mining process from indigenous micro-organisms.

Dr G Southam from the Department of Biological Sciences at Northern Arizona University discussed bacteria-mineral interactions in the deep subsurface of the West Driefontein deposit. The presence of viable bacteria in this deposit plus the ability of bacteria to catalyse the formation of octahedral gold suggest an alternative biogenic origin for this crystalline gold which is conventionally considered to be of hydrothermal origin.

Dr Susan Pfiffner from the Center for Environmental Biotechnology at the University of Tennessee described the investigation of rock, fissure water and biofilm samples taken from depths exceeding 3 kms by direct microscopy, cultivation, activity assay and analytical chemistry. Biomarker lipids indicated the presence of thermophiles, sulphate reducers and iron reducers, supporting the presence of active biogeochemical processes in the samples. Epoxide fatty acids are products of water chlorination and could be used to monitor contamination of natural waters with service water.

Dr Mary DeFlaun of Bioremediation Technologies, Envirogen, Inc. New Jersey characterised the unique microbes found in deep mines. *Thermus multireducens*, a facultative anaerobe that can reduce a range of metals and has applications in bioleaching of mine wastes, was isolated from groundwater in rock at 60°C. *Alkaliphilus transvaalensis*, a new genus and species of micro-organism was isolated from water containment dam with a pH of 11.3 and is one of the most alkaliphilic organisms ever described. A third organism, as yet an unnamed new species, was isolated aerobically at 60°C. These have been deposited with the Subsurface Microbial Culture Collection (SMCC) which characterises, distributes and preserves subsurface micro-organisms in the U.S.A.

Life in extreme environments -continued

Dr D Moser from Princeton University outlined possible utilisation of molecular and geochemical "fingerprinting" for tracking the movement of water and air in mines.

Julie Ward presented studies from the University of Toronto on the origin, occurrence and distribution of hazardous gases, such as hydrogen, methane, butane and propane in hard rock mines, their potential role in supporting deep subsurface life and implications for mining such as the calculation of lower explosive limits. There is no evidence of methanogenesis by micro-organisms.

The safety aspects of subsurface microbial community dynamics and the geochemistry will also be addressed in the forthcoming project. There are a number of research questions including:

- Do autotrophic micro-organisms dominate in the deep subsurface? (Autotrophs make organic carbon from carbon dioxide while consuming sulphide, methane and hydrogen so, in principle, could reduce the levels of hazardous gases)
- What are the mechanisms and rates for hydrogen production in the subsurface?
- What are sources, concentration and use of hydrogen by microbial communities?
- What factors affect microbial growth, biomineralisation or metal corrosion

The proposed research will establish a framework for interpreting the origin of "fissure" water and toxic gases and the mechanisms by which micro-organisms impact the mining environment, either favourably or unfavourably. Unique organisms or enzymes may also lead to biotechnology transfer with advancement in bioleaching and environmental bioremediation technologies.

Biological approaches for remediating polluted environments *in situ* provide a significant advantage over alternative techniques in terms of cost and reduction of environmental and human exposure. At the workshop, Dr Tommy Phelps of Oak Ridge National Laboratory described cost-effective groundwater degradation of trichloroethylene by methanotropic micro-organisms.

Applications of biotechnology to enhancing production and products were addressed. Dr Brendlyn Faison from Hampton University presented the potential role of anaerobic organisms in conversion of low-grade (high sulphur) coal to value-added "carbochemicals".

Dr Don Cowan currently at University College London and soon to be associated with the University of the Western Cape, reviewed the latest developments in methods to access novel gene products which circumvent the limitations of microbial "culturability".

Dr Chris du Plessis presented the sulphide mineral bioleaching technology which Billiton has developed over the last 20 years to become a world leader in the field and Brent Usher from the Institute for Groundwater Studies at the University of the Orange Free State gave an overview of impacts of mining on groundwater resources.

In an interesting departure from the focus on the mining industry, Wesley Ward from the U.S. Geological Survey gave two fascinating presentations on fundamental new observations about Mars and plans for the 2001 orbiter and 2003 orbiter/lander Mars Express mission. The workshop was concluded by a discussion on legislation and biodiversity and areas of collaboration in research and capacity building.

For further information on the workshop and the presenters, contact Dr Esta van Heerden at vheerden@micro.nw.uovs.ac.za

The SIMRAC Annual Review 2001

The SIMRAC Annual Review was held on 25 October 2000 at Mintek, Randburg. Proceedings were opened by Ms May Hermanus, Chief Inspector, Department Minerals and Energy.

The Annual Review was attended by 147 delegates from mining houses, unions, manufacturers and the Department Minerals and Energy.

Results from nine SIMRAC projects were presented and information ranged from a means to access SIMRAC research findings, rock engineering, environmental engineering, occupational hazards, machinery and engineering risks and mining systems.

Research agencies contracted to SIMRAC exhibited specific results such as a prototype drill and a falling cage arrester; instruments to measure gas liberation, the PATHAUT database and clinico-pathological studies on tuberculosis in the mining industry.

The presented papers as well as concluded final reports for the period 1999-2000 can be downloaded from the SIMRAC Website at http://www.simrac.co.za

Ethics policy for SIMRAC Projects - Mary Ross

SIMRAC expects of members, researchers and reviewers the highest standards of ethical conduct in every aspect of SIMRAC research including applications, proposals, project selection, conducting research, reports and publications.

For SIMRAC research projects involving the use of human subjects, researchers must comply with the SIMRAC ethics policy summarised below. The policy of SIMRAC on the use of human subjects will apply if the researcher intends to:

- administer a drug, take a live or post mortem tissue or body fluid sample, do a test or perform any procedure (clinical, therapeutic or otherwise) upon a human being for research;
- ask people questions, whether self-administered or researcher-administered, by telephone, letter, survey, questionnaire or interview;
- use non-public records which contain identifying information about anyone;
- observe anyone's responses or behaviour, either directly or indirectly.

Research projects involving animal subjects should comply with the relevant sections of these guidelines and guidelines provided by the appropriate committee for research on animal subjects from which ethics clearance must be obtained before research is funded and commenced.

Proposal Format

Proposals must include information on all matters relevant to complying with the guidelines.

The design and conduct of each procedure involving human subjects and the process for obtaining informed consent should be clearly explained.

The research proposal must contain a statement of the ethical considerations involved, the means to ensure ethical conduct of the research and the process of obtaining ethics clearance for the project.

Biomedical Research

Research proposals involving biomedical research on human subjects must be to improve diagnostic, therapeutic or preventive measures or to improve the understanding of the aetiology and the pathogenesis of occupational disease affecting miners. Considerations related to the well being of the human subject should take precedence over the interests of science and society. Biomedical research involving physical examination, testing or treatment of human subjects should be conducted only by scientifically qualified persons and under the supervision of a clinically competent practitioner. Details regarding informed consent are provided in an Appendix and can be obtained electronically from Mary Ross mross@simpross.co.za

For research involving pathological specimens from human tissue submitted for compensation under the Occupational Diseases in Mines and Works Act (Act 78 of 1973 and Amendment Act 1993) (ODMWA), consult guidelines in the additional available document.

Ethics Clearance

Ethics clearance must be obtained from a South African ethics committee (for human or animal subjects) approved by SIMRAC, Medical Research Council accredited ethics committees and that of the South African Medical Association, until such time as the National accrediting body is established.

In addition, if workplace ethics committees exist for the participants (e.g. a company and/or mine-based ethics committee), clearance must be obtained from it/them for research in that particular workplace. The local workplace committee has jurisdiction in that workplace if it denies ethics clearance for a study approved by the nationally accredited committee.

However, the workplace committee does not have jurisdiction over research in other institutions or workplaces. This follows common practice for multi-centre studies involving local and national ethics committees. (No national ethical, legal or regulatory requirement should be allowed to reduce or eliminate any of the protections for human subjects set forth in the World Medical Association Declaration of Helsinki) If researchers have no access to a suitable ethics committee, the SIMRAC occupational health programme manager will give advice with application for ethics clearance.

Ethics clearance must be obtained and an ethics clearance certificate submitted to SIMRAC **prior** to commencement of the project. Funding from SIMRAC will not be released to conduct the research until this requirement is fulfilled.

Ethical Misconduct

Allegations of misconduct will be taken seriously by SIMRAC. Alleged ethical misconduct in SIMRAC research or improper conduct of research reported to SIMRAC will be referred by SIMRAC for investigation and resolution by the Committee/s, which granted ethics clearance to the proposal.

All suspected unethical or improper conduct at any stage of the SIMRAC research process should be reported to the SIMRAC Research Manager or the Chairperson of the relevant sub-committee managing the research project. Claims of unethical conduct should be based on fact and not hearsay nor impression.

If, after investigation, allegations of improper conduct of research are not substantiated, SIMRAC will endeavour to restore the reputation of anyone alleged to have been involved in unethical conduct of its research projects. If the allegations are substantiated, the recommendations of the investigating ethics committee regarding project continuance will be obtained.

For more detailed guidance, researchers should consult the ethics committee through which they intend to seek clearance for the project. In addition, there are a number of Codes available on the Internet. It is suggested that researchers consult the guidelines of the South African Medical Research Council and World Medical Association Recommendations Guiding Physicians in Biomedical Research available at:

The Medical Research Council http://www.mrc.ac.za/Ethics/;
World Medical Association Declaration of Helsinki, http://www.wma.net/e/policy/;
The Nuremberg Code http://www.ushmm.org/research/doctors/Nuremberg_Code.htm

Please contact Mary Ross for additional information.

SIMPROSS produces the SIMRAC Newsletter tri-annually. For further information please contact Elsie Zinsser, Private Bag X 63, Braamfontein 2017. Email: ezinsser@simpross.co.za Contributions are welcome.

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