



MANDELA MINING PRECINCT  
MINDS FOR MINES

21-22 JUNE 2021

# Mandela Mining Precinct SYMPOSIUM

Beneficiating three years' of  
research, development and  
innovation

**Day 1** 21 June  
is targeted at industry, academia, science councils,  
OEMs, organised labour, government, etc.

**Day 2** 22 June  
is targeted at learners and students; and interns and  
young professionals in the sector.

Registration is free but mandatory.

[CLICK HERE TO REGISTER](#)

[www.mandelaminingprecinct.org.za](http://www.mandelaminingprecinct.org.za)

# Day 1 **Monday, 21 June 2021**

08:30 – 09:30

## **OPENING SESSION**

Programme director: **Sokhu Sibiya**, CSIR Communications

08:30 Welcome remarks by **Roger Baxter**, Minerals Council Chief Executive Officer  
MC: **Sokhu Sibiya**, CSIR Communications

08:40 Remarks by **Dr Thulani Dlamini**, CSIR Chief Executive Officer

08:50 Remarks, Department of Mineral Resources and Energy

09:00 Remarks, Department of Trade, Industry and Competition

09:10 Keynote address by **Dr Phil Mjwara**, Department of Science and Innovation Director General

09:30 Opening session ENDS

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09:35 – 10:25

## **PLENARY 1**

09:35 **4IR and Digital transformation in Mining**  
**Ulrich Graf**, Industrial Internet Consortium, Chairman of the Mining Vertical Group.

09:50 Q&A

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## **PLENARY 2**

10:00 **SA Mining Industry response to Covid-19**  
**Dr Thuthula Balfour**, Minerals Council South Africa, Head of Health

10:15 Q&A

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10:25 – 10:30	<b>COMFORT BREAK</b>		
<b>LIGHTNING TALKS</b>	<b>TRACK 1</b>	<b>TRACK 2</b>	<b>TRACK 3</b>
10:30 – 11:10	<b>ACADEMIC PARTNERS IN PURSUIT OF NOVEL ROCK BREAKING TECHNIQUES</b>	<b>ACADEMIC AND SCIENCE COUNCIL PARTNERS - ACHIEVING OPTIMISATION IN MINING</b>	<b>SCIENCE COUNCILS AND INDUSTRY WORKING TOWARDS THE READINESS OF THE INDUSTRY TO ADOPT 4IR</b>
10:30 – 10:40	<p><i>LIGHTNING TALK (1)</i></p> <p><b>PURSUING THERMAL SPALLING AS A NOVEL ROCK-BREAKING TECHNIQUE – THE R&amp;D</b></p> <p><i>Drill and blast compromises safety and delays production. There is an urgent need to develop a method that can produce 24/7/365 with minimum dust, fumes and stress change.</i></p> <p><b>Prof Ray Durrheim</b> South African Research Chair in Exploration, Earthquake &amp; Mining Seismology, University of the Witwatersrand</p>	<p><i>LIGHTNING TALK (2)</i></p> <p><b>OPTIMISING THE PRODUCTION CYCLE</b></p> <p><i>Testing technologies to determine possible optimisation achieved in completing the production cycle – several recommendations are made.</i></p> <p><b>Dr Bertie Meyer</b> Senior lecturer, University of Pretoria</p>	<p><i>LIGHTNING TALK (3)</i></p> <p><b>ASSESSMENT BASELINE STUDY, CYBER PHYSICAL SYSTEMS</b></p> <p><i>This research contributes to the Real-Time Information Management Systems (RTIMS) Industrial Internet of Things (IIOT) core platform by focusing on the R&amp;D required to deploy a network of IIOT devices in-stope.</i></p> <p><b>Carel Kruger</b> Senior Engineer, CSIR</p>
10:40 – 10:50	<p><i>LIGHTNING TALK (4)</i></p> <p><b>ROCK ENGINEERING – IMPACTS ON MODERNISATION</b></p> <p><i>Analyses of rock engineering formulas currently in use in the South African mining industry - their pros and cons, and recommendations on a way forward</i></p> <p><b>Prof Francois Malan</b> Director: Mining Resilience Research Centre, University of Pretoria</p>	<p><i>LIGHTNING TALK (5)</i></p> <p><b>OPTIMISING THE SHIFT CYCLE</b></p> <p><i>Review of existing shift cycles, and scenarios</i></p> <p><b>Dr Bertie Meyer</b> Senior lecturer, University of Pretoria</p>	<p><i>LIGHTNING TALK (6)</i></p> <p><b>UNDERGROUND NETWORK COMMUNICATIONS AT THE STOPE</b></p> <p><i>Five possible use cases are identified and presented for the achievement of underground communications over the last 100m to the stope.</i></p> <p><b>Braam Greeff</b> Principal Systems Engineer, CSIR</p>

<p>10:50 – 11:00</p>	<p><i>LIGHTNING TALK (7)</i></p> <p><b>GEOLOGICAL MAPPING AND THE INTEGRATION OF A 3D LIDAR SCAN</b></p> <p><i>Evaluation of integrated scanning technology for the identification of reef and geological features. Aim of the study was to test the viability of 3D laser scanning technology to identify and map the geology for possible automation.</i></p> <p><b>Mbali Mpaza</b> Lecturer, University of Johannesburg</p>	<p><i>LIGHTNING TALK (8)</i></p> <p><b>ACHIEVING EFFICIENCIES IN ENERGY UTILISATION</b></p> <p><i>Research conducted to establish plant-wide energy efficiency best practices and guidelines for future mechanised mining systems and operations. An energy efficiency guideline was developed as an outcome of this study.</i></p> <p><b>Dr Xianming Ye</b> Associate Professor of Energy, University of Pretoria</p>	<p><i>LIGHTNING TALK (9)</i></p> <p><b>UNDERGROUND ELECTRONIC CAPTURING AND REPORTING SOLUTION</b></p> <p><i>Interventions to improve the current manual-based safety-data recording and management processes; by converting it into an electronic capturing and reporting system.</i></p> <p><b>Braam Greeff</b> Principal Systems Engineer, CSIR</p>
<p>11:00 – 11:10</p>	<p><b>WRAP UP AND Q&amp;A</b></p> <p>Host: <b>Michelle Pienaar</b> Programme Manager: Advanced Orebody Knowledge, Mandela Mining Precinct</p>	<p><b>WRAP UP AND Q&amp;A</b></p> <p>Host: <b>Martin Pretorius</b> Programme Manager: Mechanised Mining Systems &amp; Longevity of Current Mines, Mandela Mining Precinct</p>	<p><b>WRAP UP AND Q&amp;A</b></p> <p>Host: <b>Jean-Jacques Verhaeghe</b> Programme Manager: Real-Time Information Management Systems, Mandela Mining Precinct</p>

BRINGING POLICY TO LIFE – SPOT LIGHT ON THE ROLE OF MINING IN THE DSI WHITE PAPER ON STI

11:20 - 11:40	<b>TRACK 4</b> <b>ENHANCING THE CULTURE OF INNOVATION</b>	<b>TRACK 5</b> <b>FAST TRACKING THE DEVELOPMENT OF MINING EQUIPMENT TO EXPLOIT SA'S MINERAL RESOURCES</b>	<b>TRACK 6</b> <b>EXPANDING THE RESEARCH SYSTEM</b>
11:20 – 11:40	<p><b>PANEL DISCUSSION: TRADITIONAL R&amp;D VS. INNOVATION CHALLENGES</b></p> <p><i>This discussion will focus on the timeline of the Mandela Mining Precinct's Isidingo Drill Design challenge, highlighting how the model of an open innovation challenge speeds up innovation.</i></p> <p>Host: <b>Reyhana Mahomed</b> Marketing and Communications, Mandela Mining Precinct</p> <p>Panellist: <b>Martin Pretorius</b> Programme Manager: Mechanised Mining Systems &amp; Longevity of Current Mines, Mandela Mining Precinct</p> <p>Panellist: <b>Clen Cook</b> Innovation Consultant, Research Institute for Innovation and Sustainability</p>	<p><b>LAUNCH: NATIONAL PGM AND AU RESOURCE ATLAS</b></p> <p><i>The National Resource Atlas is a direct reflection of the vision of SAMERDI which is to maximise the returns of South Africa's mineral wealth to ensure the sustainability of the industry.</i></p> <p><b>Michelle Pienaar</b> Programme Manager: Advanced Orebody Knowledge, Mandela Mining Precinct</p> <p><b>Richard Kaufholz</b> Chief Technology Officer, Esri South Africa</p> <p><b>Sarah Pein</b> Researcher, University of Johannesburg</p>	<p><b>RE-IMAGINING MINING THROUGH ACCELERATED MINING INNOVATION CAPACITY-BUILDING</b></p> <p><i>Overview of the research capability and capacity pilot study undertaken by the CSIR; highlighting the importance of such studies for both government and industry, the gaps identified and/or anticipated; and how these gaps can be addressed in light of a modernising mining industry.</i></p> <p>Host: <b>Sietse van der Woude</b> Senior Executive: Modernisation and safety, Minerals Council</p> <p>Panellist: <b>Johan Strydom</b> Strategic Research Manager, CSIR</p> <p>Panellist: <b>Bongji Ntsoelengoe</b> Executive Manager: Future Production - Mining, CSIR</p> <p>Panellist: <b>Vanessa Naicker</b> Head of Global Talent, Anglo American</p> <p>Panellist: <b>Roby Stancel</b> Managing Partner, VCI and Innovation Architects</p>
11:40 – 11:50	Q&A	Q&A	Q&A

11:50 – 12:10

**PLENARY 3**

**11:50 Beneficiating collaborations & partnerships for the sustainability of the South African Mining Industry**

*This presentation will expand on the strategic importance of the new research partners and the SAMERDI Research Centres, emphasising the growth of the Precinct over the last three years; its exceptional performance on RDI which necessitated an expansion of research partners.*

**Dick Kruger**, Co-Director, Mandela Mining Precinct

12:10 – 12:30

**LUNCH**

**PANEL DISCUSSIONS**

12:30 – 12:50

**TRACK 7**

**FOCUS ON PEOPLE-CENTRIC AND INCLUSIVE MINING**

**TRACK 8**

**THE MANDELA MINING PRECINCT – MEMSA PARTNERSHIP: A LOOK BACK AT THREE YEARS’ OF FRUITFUL COLLABORATIONS AND INITIATIVES**

**MEMSA**

12:30 – 12:50

**COMMUNITY ENGAGEMENT AND INCLUSIVITY**

*A riveting discussion on community engagement and benefit-sharing in the context of mining modernisation. The aim of the research was to develop a community engagement and inclusivity model that supports shared value creation in the context of mining modernisation.*

Host: **Dr Ingrid Watson**  
Programme Manager, Wits Mining Institute

Panellist: **Dr Nancy Coulson**  
Visiting senior lecturer, Wits Mining Institute

Panellist: **Sifiso Dlamini**  
Senior researcher, CSIR

**DRIVING CLUSTER COLLABORATION IN RDI**

*The Mining Equipment Manufacturers of South Africa (MEMSA) is an industry cluster of mining equipment manufacturers that views technology development as key to sustainability and growth, and has placed great value on its collaborative relationship with the Mandela Mining Precinct. The presentation will look back at a number of fruitful collaborations and initiatives around technology development over the past three years, provide an overview of current initiatives, and consider the role of industry clusters in the technologically competitive, challenging and rapidly evolving context of mining equipment and systems.*

**Freddy Muger**  
Chairperson, MEMSA

12:50 – 13:00	Q&A		
13:10 – 14:00	<b>TRACK 9</b> <b>PEOPLE-CENTRIC MODERNISATION</b>	<b>TRACK 10</b> <b>TESTING OF PROMISING TECHNOLOGIES</b>	<b>TRACK 11</b> <b>4IR IN MINING</b>
<b>LIGHTNING TALKS</b> 13:10 – 13:20	<p><i>LIGHTNING TALK (10)</i></p> <p><b>PEOPLE-CENTRIC MODERNISATION</b></p> <p><i>This study answers the important questions around the inclusion of stakeholders in the design and development of equipment, in support of people-centric mining modernisation.</i></p> <p><b>Dr Jodi Pelders</b> Researcher, CSIR</p>	<p><i>LIGHTNING TALK (11)</i></p> <p><b>EXPLORING AN UNDERGROUND TEST FACILITY FOR SOUTH AFRICA</b></p> <p><i>Is South Africa ready for an underground test facility? This presentation answers this important question, and explores the feasibility of such a facility to leap the industry to IR4.0.</i></p> <p><b>Jurgens Visser</b> Programme Manager: Mandela Mining Precinct</p>	<p><i>LIGHTNING TALK (12)</i></p> <p><b>RTIMS DATA ARCHITECTURE</b></p> <p><i>The development of a datapipeline that will allow for the flow of data from mine sensor to local on-site computers/cloud where the data can be utilised (and vice versa).</i></p> <p><b>Malise Steyn</b> Researcher, CSIR</p>
13:20 – 13:30		<p><i>LIGHTNING TALK (13)</i></p> <p><b>TUNNEL SEISMIC PREDICTION FOR IMAGING AHEAD OF THE MINING FACE</b></p> <p><i>This study investigates the exploitation of the existing mine structure using seismics to see ahead of the mining face during mine development and/or expansion.</i></p> <p><b>Dr Michael Westgate</b> Postdoctoral Researcher, University of the Witwatersrand</p>	<p><i>LIGHTNING TALK (14)</i></p> <p><b>MODELLING AND VISUALISATION</b></p> <p><i>Demonstration of distributed processing, analytics and the aggregation of geospatial vector sensor data.</i></p> <p><b>Dr Nicolene Botha</b> Researcher, CSIR</p>

<p>13:30 – 13:40</p>	<p><i>LIGHTNING TALK (15)</i></p> <p><b>MINING SKILLS 4.0</b></p> <p><i>The mine of the future will utilise more and more technologies, irrespective of whether it is mechanised or not. This presentation focuses on the skills required to ensure users/mine employees are equipped and skilled for a just transition into 4IR.</i></p> <p><b>Alexandra Lugagne</b> Engagement Manager, Research Institute for Innovation and Sustainability</p>	<p><i>LIGHTNING TALK (16)</i></p> <p><b>TESTING OF TECHNOLOGIES TO IDENTIFY GEOLOGICAL STRUCTURES ON THE FACE</b></p> <p><i>A better understanding of the excavation stability is necessary. The AOK research team investigates non-destructive methods to map structures within the hangingwall and the skin of the excavation.</i></p> <p><b>Thabang Kgarume</b> Geophysicist, CSIR</p>	<p><i>LIGHTNING TALK (17)</i></p> <p><b>MACHINE LEARNING FOR SUBSURFACE GEOLOGICAL AND GEOPHYSICAL DECISION MAKING</b></p> <p><i>Investigation on how big data sets can be used for prediction - with a focus on seismic and geological mapping; and structural and pothole prediction.</i></p> <p><b>Dr Glen Nwaila</b> Adjunct professor, University of the Witwatersrand</p>
<p>13:40 – 13:50</p>	<p><i>LIGHTNING TALK (18)</i></p> <p><b>IMPACT OF MODERNISATION ON JOBS</b></p> <p><i>Research conducted towards an enhanced understanding of jobs lost in the last three years in the sector and the associated levels, skills and designations; the multiplier effect (mining jobs impact on the economy); and the post-mining job options of ex-mine employees. The output for this study is a Jobs Impact Framework.</i></p> <p><b>Wessel Botha</b> Consultant, University of Pretoria Enterprises</p>	<p><i>LIGHTNING TALK (19)</i></p> <p><b>IN-MINE ELECTRICAL RESISTANCE TOMOGRAPHY (ERT) TRIALS</b></p> <p><i>The key to achieving zero harm while still achieving optimal extraction begins with a good understanding of the structure and characteristics of the orebody and of any unexpected or anomalous and potentially hazardous geological structures ahead of the mining face. The proposed solution is presented as the routine application of a “geological toolbox” approach comprising: ERT, BHR, and GPR.</i></p> <p><b>Michael van Schoor</b> Principal geophysicist, CSIR</p>	<p><i>LIGHTNING TALK (20)</i></p> <p><b>RTIMS BLUEPRINT – CASEWISE TOOLS</b></p> <p><i>This presentation offers a scenario of a mine manager having an overview of operations at their fingertips, enabled by a systems of systems approach.</i></p> <p><b>Odirile Motlhaga</b> OT Service Delivery Head, Harmony Gold</p>



13:50 – 14:00	<p><b>WRAP UP / Q&amp;A</b></p> <p>Host: <b>Dr Sherin Ramparsad</b>  Programme Manager: Successful Application of Technologies Centred Around People</p>	<p><b>WRAP UP / Q&amp;A</b></p> <p>Host: <b>Michelle Pienaar</b>  Programme Manager: Advanced Orebody Knowledge, Mandela Mining Precinct</p>	<p><b>WRAP UP / Q&amp;A</b></p> <p>Host: <b>Jean-Jacques Verhaeghe</b>  Programme Manager: Real-Time Information Management Systems, Mandela Mining Precinct</p>
14:00 – 14:10	<p><b>CLOSING SESSION</b></p> <p>Closing remarks and vote of thanks  <b>Johan Le Roux</b>  Co-Director, Mandela Mining Precinct</p>		

## Day 2 **Tuesday, 22 June 2021**

09:00 – 09:25	<p><b>OPENING SESSION</b></p> <p>Programme Director: <b>Sokhu Sibiya</b>, CSIR Communications</p> <p>09:00 Welcome Remarks by <b>Ahsan Mahboob</b>, Head of Sibanye-Stillwater Digital Mining Laboratory</p> <p>09:10 Keynote address by <b>Waseem Carrim</b>, National Youth Development Agency Chief Executive Officer</p> <p>09:25 Opening session ENDS</p>
09:30 – 09:55	<p><b>PLENARY 1</b></p> <p>09:30 A career in the mining industry  What does a career in mining in South Africa look like? Bongi shares her experiences  <b>Bongi Ntsoelengoe</b>  Executive Manager: Future Production Mining, CSIR</p> <p>09:45 – 09:55 Q&amp;A</p>

09:55 – 10:20	<b>PLENARY 2</b> 09:55 Introducing the SAIMM Young Professionals Council <b>Kondwani Banda</b> Engineer, Mintek 10:10 – 10:20 Q&A	
10:20 – 10:30	<b>COMFORT BREAK</b>	
10:30 – 10:55	<b>PLENARY 3</b> 10:30 What does modernisation in mining mean? How has the mining industry evolved; and how will it continue evolving as we transition to Industry 4.0? <b>Sietse van der Woude</b> Senior Executive: Modernisation and Safety, Minerals Council South Africa 10:45 – 10:55 Q&A	
<b>LIGHTNING TALKS PRESENTATIONS</b> 11:00 - 11:50	<b>TRACK 1</b> <b>MODERNISATION AND PEOPLE FACTORS</b>	<b>TRACK 2</b> <b>TECHNOLOGIES FOR MINING – TRIAL AND ERROR</b>
	<i>LIGHTNING TALK (21)</i> <b>HEALTH-CARE SUPPORT FOR EMPLOYEES AND LOCAL COMMUNITIES DURING THE COVID-19 PANDEMIC</b>  <i>How is the mining industry supporting employees and communities to deal with the Covid-19 pandemic in South Africa? This is the key question this presentation responds to.</i>  <b>Tshepo Chabalala</b> Project Administrator, Mandela Mining Precinct	<i>LIGHTNING TALK (22)</i> <b>THERMAL SPALLING – THE TRIALS AND ERRORS</b>  <i>With many years' of mining experience, South Africa is known as masters of rock breaking. This presentation explores thermal spalling as a feasible rock-breaking method.</i>  <b>Nandipha Masondo</b> Masters student, University of the Witwatersrand

<p>11:10 – 11:20</p>	<p><i>LIGHTNING TALK (23)</i></p> <p><b>SKILLS NEEDS FOR MODERNISATION</b></p> <p><i>What are the skills needs for certain roles in the industry as we transition to a modernised mining industry?</i></p> <p><b>Wessel Botha</b> Consultant, University of Pretoria Enterprises</p>	<p><i>LIGHTNING TALK (24)</i></p> <p><b>GROUND PENETRATING RADAR – UNDERGROUND TESTING</b></p> <p><i>Identification of a non-destructive technology to map out the structure of excavations. This is in pursuit of the industry-wide zero-harm objectives.</i></p> <p><b>Katlego Matlou</b> Intern, Mandela Mining Precinct</p>
<p>11:20 – 11:30</p>	<p><i>LIGHTNING TALK (25)</i></p> <p><b>SUPPORT TECHNOLOGIES AND METHODOLOGIES FOR USE IN SA NARRO REEF, HARD ROCK MINES</b></p> <p><i>Development of systems and technologies that will combat fatalities in underground mines</i></p> <p><b>Moreen Marota</b> Intern, Mandela Mining Precinct</p>	<p><i>LIGHTNING TALK (26)</i></p> <p><b>TUNNEL SEISMIC PREDICTION – SURFACE TESTING</b></p> <p><i>Investigation into technologies that will be used to obtain information ahead of the face, such as tunnel seismic prediction.</i></p> <p><b>Kenneth Rapetsoa</b> Intern, Mandela Mining Precinct</p>
<p>11:30 – 11:40</p>	<p><i>LIGHTNING TALK (27)</i></p> <p><b>GUIDELINE FOR AN EFFICIENT MINING CYCLE SYSTEM</b></p> <p><i>The development of a blueprint for an efficient mining cycle utilising different equipment suites for au and PGM.</i></p> <p><b>Sibusiso Ngobese</b> Researcher, CSIR</p>	<p><i>LIGHTNING TALK (28)</i></p> <p><b>A REVIEW OF PNEUMATIC VS. HYDROPOWER ROCK DRILLS</b></p> <p><i>What is the best power source to be employed in NRHR mines? Is there an alternate power source to replace compressed air?</i></p> <p><b>Sandile Ncongwane</b> Intern, Mandela Mining Precinct</p>

11:40 – 11:50	<p><b>WRAP UP AND Q&amp;A</b></p> <p>Host: <b>Dr Sherin Ramparsad</b>  Programme Manager: Successful Application of Technologies Centred Around People; and</p> <p><b>Martin Pretorius</b>  Programme Manager: Mechanised Mining Systems &amp; Longevity of Current Mines, Mandela Mining Precinct</p>	
11:50 – 12:10	<p><b>COMFORT BREAK</b></p>	
<p><b>LIGHTNING TALKS</b></p> <p>12:10 – 13:10</p>	<p><b>TRACK 3</b>  <b>PARTNERS, COLLABORATORS</b></p> <p><b>TRACK 4</b>  <b>PARTNERS, COLLABORATORS</b></p>	
12:10 – 12:20	<p><i>LIGHTNING TALK (29)</i></p> <p><b>NATIONAL RESOURCE ATLAS</b></p> <p><i>Identification of unmined au and PGM resources that could be mined by modern/alternative mining methods.</i></p> <p><b>Zintle Nontso</b>  Researcher, CSIR</p>	<p><i>LIGHTNING TALK (30)</i></p> <p><b>MEMSA AS AN INDUSTRY CLUSTER: OUR ROLE IN BUILDING THE MINING SUPPLY CHAIN</b></p> <p><i>An introduction to the Mining Equipment Manufacturers of South Africa (MEMSA).</i></p> <p><b>Lufuno Ramabulana</b>  Admin and Communications officer, MEMSA</p>
12:20 – 12:30	<p><i>LIGHTNING TALK (31)</i></p> <p><b>FE-MN REMOVAL</b></p> <p><b>Lebogang Nhleko</b>  Geoscientist, Council for Geosciences</p>	<p><i>LIGHTNING TALK (32)</i></p> <p><b>THE ROLE OF MEMSA IN DRIVING INNOVATION AND TECHNOLOGY DEVELOPMENT</b></p> <p><i>This presentation touches on some of the many initiatives led by MEMSA in driving innovation and technology development in South Africa.</i></p> <p><b>Livhuwani Khobo</b>  Research, Communication and admin officer, MEMSA</p>

<p>12:30 – 12:40</p>	<p><i>LIGHTNING TALK (33)</i>  <b>ILLEGAL MINER MAPPING</b></p> <p><b>Gabrielle Denner</b>  Junior Scientist, Council for Geosciences</p>	<p><i>LIGHTNING TALK (34)</i>  <b>MARKET SOLUTIONS REVIEW</b></p> <p><i>A comparison and review of the current underground communication technologies that are manufactured and available locally.</i></p> <p><b>Nepo Marebane</b>  Intern, Mandela Mining Precinct</p>
<p>12:40 – 12:50</p>	<p><i>LIGHTNING TALK (35)</i>  <b>BENTHIC HABITAT MAPPING USING MACHINE LEARNING</b></p> <p><b>Dr Talicia Pillay</b>  Scientist, Council for Geosciences</p>	<p><i>LIGHTNING TALK (36)</i>  <b>RTIMS BLUEPRINT - CASEWISE TOOLS</b></p> <p><i>This presentation offers a scenario of a mine manager having an overview of operations at their fingertips, enabled by a systems of systems approach.</i></p> <p>Host: <b>Humna Malik</b>  Senior Engineer, CSIR</p>
<p>12:50 – 13:00</p>	<p><b>WRAP UP / Q&amp;A</b></p> <p>Host: <b>Michelle Pienaar</b>  Programme Manager: Advanced Orebody Knowledge, Mandela Mining Precinct</p>	<p><b>WRAP UP / Q&amp;A</b></p> <p>Host: <b>Jean-Jacques Verhaeghe</b>  Programme Manager: Real-Time Information Management Systems, Mandela Mining Precinct</p>
<p>13:00 – 13:30</p>	<p><b>CSIR GRADUATE PROGRAMME AND OUTREACH STRATEGY</b>  <b>Nokuthula Zama</b>, Manager: Graduate Development, CSIR</p>	
<p><b>ENDS</b></p>		