

# Paste 2019

## Proceedings of the 22nd International Conference on Paste, Thickened and Filtered Tailings

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# Australian Centre for Geomechanics

The Australian Centre for Geomechanics (ACG) was formally established in 1992 as a University of Western Australia research centre in order to promote research excellence and continuing education in geomechanics, with particular emphasis on its application to the mineral and energy extraction sections of Australia's resources industry.

The Australian Centre for Geomechanics is an unincorporated Joint Venture involving:

- CSIRO Mineral Resources
- The University of Western Australia — Civil, Environmental and Mining Engineering

The ACG draws together staff knowledge, experiences and expertise from within the two groups forming the Centre and facilitates a multi-disciplinary approach to research and education in geomechanics. Research undertaken by the ACG attracts both national and global support and the outcomes of the projects are utilised to promote safer mining and environmental geomechanics practices, operating efficiencies and to meeting community expectations for sustainable mining practices.

With the guidance of strong industry representation on the Board of Management, and close collaboration with senior representatives of the mining industry, research, training and further education activities are tailored directly to the needs of industry. The ACG Board expects the Australian Centre for Geomechanics to be the focal point for industry on geomechanics issues and to address the needs of industry through a collaborative interdisciplinary approach.

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The 22nd International Conference on Paste, Thickened and Filtered Tailings papers are available on the repository.

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# Paterson & Cooke

Paterson & Cooke was formed in 1991 by Dr Angus Paterson and Dr Robert Cooke in Cape Town, South Africa with the aim of providing consulting services specialising in hydraulics and slurry pipeline transport to the mining industry. With a background in the flow behaviour of high concentration slurries, Paterson & Cooke soon established itself as the expert company for designing deep mine backfill reticulation systems and conventional, thickened and paste tailings pipelines systems. With a strong foundation in a fundamental understanding of slurry pipeline hydraulic, Paterson & Cooke extended its range of services to offer comprehensive backfill, slurry pipeline, process and mining technology solutions.

Paterson & Cooke's engineering capabilities include:

- Process, hydraulic and mechanical design of long-distance concentrate pipeline systems and conventional, thickened and paste tailings pipeline systems.
- Design and engineering of hydraulic, paste and rock fill preparation plants and underground distribution systems.
- Analysis and design of deep mine high pressure dewatering and pressure exchange systems.
- Process engineering and design of thickening and filtered systems.
- Specialist engineering, including computational fluid dynamics, pipeline stress analysis and transient analysis.
- Construction management.
- Commissioning and start-up of process, pump and pipeline systems.
- Post commissioning maintenance and operations management of slurry pipeline and backfill systems.

Paterson & Cooke's philosophy of understanding the materials we deal with is supported by our network of laboratory test facilities in the regions in which we operate that provide:

- Backfill laboratory services, including material characterisation, strength testing and triaxial testing.
- Slurry test laboratory services, including pipe loop and viscometer testing.
- Cyclone performance testing.
- Pilot plant test facilities.

In addition to engineering and laboratory services, Paterson & Cooke also develops proprietary technology that includes the Vector® feedwell and HydroForce controllable feed dilution system to improve the performance of new and existing thickeners, as well as dewatering bins to separate coarse and fine slurry streams, novel fluidisers, flow splitters, and a range of purpose built strength backfill strength testing machines and instrumentation.

Paterson & Cooke operates from offices in Australia, Canada, Chile, South Africa, the UK and the USA.



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The dedicated efforts of the peer reviewers have resulted in the high quality of the technical programme and the papers compiled for this publication. The editors thank the following people who contributed their time and expertise as reviewers of manuscripts for the proceedings of the 22nd International Conference on Paste, Thickened and Filtered Tailings held in Cape Town, South Africa. A technical and critical review of each paper was undertaken by a minimum of two reviewers for the production of this volume.

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# Preface

The 22nd International Conference on Paste, Thickened and Filtered Tailings is the first to formerly include filtered tailings as a natural extension of the conference theme and is a fitting time to acknowledge the many advances that have been made in dewatering technologies since the forum began in 1998. This is the fifth time that the conference is being held in Southern Africa and the 2019 event is co-hosted in Cape Town, South Africa, by the Australian Centre for Geomechanics and Paterson & Cooke.

This forum has always been particularly relevant to Southern Africa, a water-stressed and arid region that has many competing demands on limited, and often seasonal, water resources. Legislation in South Africa, which is at risk of a water deficit, is focussed on ensuring the mining industry manages the available water quality and quantity through water conservation measures to mitigate water losses. Such requirements are commonplace in other arid regions where water is at a premium, and solutions that were previously unavailable or cost-prohibitive are now being developed and considered as viable alternatives to conventional tailings disposal.

Many of the early proceedings dealt with the concept of dry-stacking and the requirements for de-watering to high solids concentrations, and the timing was apt as high-rate and paste thickeners were becoming increasingly efficient. As these technologies developed, many operations embraced thickened tailings or paste deposition strategies, and this series of conferences established itself as the benchmark forum for the advancement of high concentration tailings disposal and continues to be the showcase for the technology. Some of the first papers on filtered tailings were presented in Belo Horizonte, Brazil in 2013, and as demand grew for larger capacity filters, the industry followed suit with the development of units with larger filter areas and improved cycle times that process significant volumes of material. Many projects now consider thickened, paste and filter option assessments and, as filters become more efficient, there is a merging of technologies using combinations of high-rate thickening and filtration for optimal de-watering and deposition.

Many abstracts were submitted, and the final selection of papers includes a range of surface disposal options and case studies that include conversion of conventional facilities to thickened tailings and closure studies, de-watering options from thickening to filtration, and mine backfilling.

The January 2019 tailings dam failure in Brazil and heart-breaking loss of life and devastation focussed the world's attention on the mining industry and the consequences will be felt for years to come. It is beholden on all those involved in mining, and particularly those responsible for the design and operation of tailings storage facilities, to incorporate the lessons learned into future geotechnical designs to improve the safe operation of such facilities. It is hoped that these proceedings add to the body of knowledge that will result in water-wise and safe storage facilities that minimise the likelihood of future failures of such magnitude.

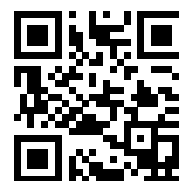
On behalf of my co-editors, Andy Fourie and David Reid, I would like to express thanks to everyone who played a part in assembling these proceedings. This includes the authors, the technical and editorial committess, the reviewers, and the staff at the Australian Centre for Geomechanics and Paterson & Cooke.

Special mention must go to Garth Doig, Candice McLennan, Christine Neskudla, Josephine Ruddle, Gesa Witte and Stefania Woodward for their support and effort in ensuring that the proceedings are of the highest quality and for organising the event with meticulous care.

An event such as this could not have taken place without the support of our industry sponsors. Thank you to all sponsors for your involvement in and your support of this conference series.

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Dr Angus Paterson, Paterson & Cooke, South Africa  
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