



INTERNATIONAL

MINING

Technology



HALL OF FAME

Steve Morrell / COMMINATION



Dr Steve Morrell is a minerals processing engineer with over 30 years of specialist experience in the resources industry. He has been involved in the circuit design of the majority of major comminution circuits internationally, through which he has established himself as a world leading expert in comminution design and optimisation.

Morrell joined the JKMRC as a Master's student some 30 years ago. His project was to extend the AG/SAG mathematical model developed by Kam Leung. However Steve's project had an additional challenge. A big part of his project was to measure and size a SAG mill load at the sponsor site. The sponsor site was ALCOA. The mill was fed with bauxite and the process liquor was hot caustic soda.

When Steve carried out this task with enthusiasm and skill and without complaint, the old hands at the JKMRC formed a view that Steve would go far in the world of SAG milling. Steve continued to a PhD in which he aspired to answer all of the relevant SAG questions ie. modelling, ore characterisation, power, dynamics etc. However these ambitions would comprise at least five doctoral projects. After extended debate, he concentrated on measurement and prediction of AG/SAG power mill draw. This was a highly contentious issue at the time. Steve's project converted power measurement and prediction for AG/SAG mills into "business as usual" and the power model was incorporated into JKSimMet. He also developed the Variable Rates SAG mill model which is still standard in JKSimMet. Steve was a member of the project team which received the Aus IMM Operations Mineral Industry Operating Technique Award for the development of JKSimMet.

While Steve was working on his PhD he succeeded Tim Napier-Munn as leader of the long running AMIRA P9 project. During his leadership of P9, Steve and his team made major contributions to comminution, classification and even to liberation as part of the CMTE Fine Grinding project.

After contributing to the JKMRC Blue Book "Mineral Comminution Circuits – Their Operation and Optimisation", Steve became co-leader of the AMIRA Mine to Mill project with Andrew Scott. This allowed his ideas in comminution to be extended towards the

pit and to work with Andrew to quantify the many synergies which become available when blasting is considered to be the first stage of comminution. The industry adopted their ideas in record time (AusIMM Mine to Mill Conference, 1998). The more astute mining companies make good use of these ideas to this day.

Steve was also a member of the project team which received the Aus IMM Operations Mineral Industry Operating Technique Award for the AMIRA Mine to Mill project.

The Mine to Mill project also exposed the need for better breakage characterisation techniques which could be used on small samples.

Now an independent consultant, Steve worked to develop the SMC test. This test could be used on drill cores to estimate the JK A*b parameter. It was later adapted to small samples of broken rock and is now a standard test for what became known as Geometallurgy. The AMIRA GEM projects have pursued application of this strategy to other ore properties with some degree of success. The SMC test is licensed widely to laboratories with JK Drop Weight Testers. Steve was also the co-developer (with Doug Brown) of the JKMRC Drop Weight Tester.

Steve also supervised the development of a JKMRC mathematical model of the High Pressure Grinding Roll. This model is also included in the JKSimMet and has enjoyed broad success and model development is ongoing.

During the years from 2000 to 2010, Steve was been a highly successful, independent consultant who is well respected by both operators and equipment suppliers. I doubt that there are any major AG/SAG installations that he has not been asked to review or to assist with mill selection.

In 2003, based on his extensive practical and research-based experience, Steve founded SMC Testing Pty Ltd to license the innovative SMC Test® – a laboratory comminution test which provides a range of information on the breakage characteristics of rock samples for use in the mining/minerals processing industry. The SMC Test is one of the most useful, versatile and cost-effective rock breakage test



procedures available.

Since its inception in 2004, SMC Testing has conducted over 35,000 SMC Tests on behalf of the majority of the world's mining companies. These tests cover over 1,000 different orebodies across 80 countries and constitute one of the largest data bases of its kind in the world. The SMC Test, unlike any other comminution test available on the market, enables both power-based calculations and simulation studies to be conducted. It has been proven through benchmarking against an unprecedented 120 processing plants around the world, covering just about every type of comminution circuit in operation, including the largest to the smallest equipment available on the market, and treating from some of the softest to the hardest ores that have been discovered to date. This enables the SMC Test® to provide unparalleled versatility, precision and accuracy compared to other alternatives.

In 2016, the Global Mining Standards and Guidelines Group (GMSG) recognised the SMC Test through the publication of its guideline “Morrell method for determining comminution circuit specific energy and assessing energy utilization efficiency of existing circuits”.

The guideline describes the “Morrell” approach for predicting the specific energy requirements of conventional crushing, High Pressure Grinding Rolls and tumbling mill circuits through the use of the SMC Test as well as how to assess the energy utilisation efficiency of existing comminution circuits. As Barrick Gold reported, this methodology was one of the key technologies employed by them in a program started in 2008.

This program lead to significant savings at a number of Barrick’s operations which have been quoted as follows:

“Results have been very positive with more than 20% net grinding energy improvement in one case. These actions have lead to more than 43,000 t/y reduction in CO2 emissions in the three operations reviewed. Relative to Barrick’s total “carbon footprint”, this represents a net efficiency improvement of almost 1% and supports one of the key pillars of Barrick’s climate change standard. Overall the three sites reviewed have reduced energy consumption by about 61 million kWh per year in relative terms. This cost saving of about \$5 million per year has been further augmented with more than 200 combined tonnes per hour of throughput providing in the order of 60,000 ounces of gold annually.”

Dr Steve Morrell was given a lifetime achievement award at the SAG Conference in September 2011 and the Art MacPherson Award for 2011 by the Canadian Mineral Processors Society of CIM.

