30th Florida SME and Dreyer Conference

Minerals for Agriculture

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For the past 30 years, The Florida Section SME has organized this unique cross disciplinary conference which will be the place for mining, chemical processing, reclamation and environmental experts, locally and internationally, to exchange technical information and ideas.

Sponsors are the Society for Mining Metallurgy & Exploration (SME); the American Institute of Chemical Engineers (AIChE); the American Institute of Professional Geologists (AIPG); Association of Fertilizer and Phosphate Chemists (AFPC).

As the world’s population expands, it is imperative to educate people regarding the need for phosphate and other agricultural mineral mining and new technologies that help us increase productivity while using sound environmental strategies. To stay competitive and be successful in world markets, we must clearly communicate and “call-to-action” those involved with these much needed commodities.
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WELCOME AND OVERVIEW

The 30th Florida SME and 4th Dreyer Conference: 2015 Minerals for Agriculture

On behalf of the Florida Section of the Society for Mining, Metallurgy & Exploration (FLSME) and the Industrial Minerals & Aggregates Division of SME, we welcome you to the 30th Florida SME and the 4th Dreyer Conference on Industrial Minerals.

The Dreyer conferences are designed to focus on the geology of industrial mineral resources. The conference is named for Robert M. Dreyer, a former chair of the Industrial Minerals Division (1963). Dreyer established a trust to be used to fund professional activities, and this year the IM&AD joins with the FLSME in highlighting the benefits we realize from these minerals and in celebrating the dedication, professionalism and continuing excellence of the Florida Section in this, their 30th Regional Technical Conference.

This conference is intended to provide a professional forum to promote an open exchange of ideas between participants. The speakers invited to present are members of a select group of renowned experts on the geology, mining and land reclamation, mineral and chemical processing, production, markets and innovations of agricultural minerals.

The fertilizer industry has faced many challenges in the recent past with consolidation among larger producers and many new junior companies entering the business. Demand has been driven not only by the need to provide sustainable food supplies to growing developing economies, but by increased interest in bio-fuels among the more developed ones. This conference serves as a medium to enhance your knowledge regarding the geology, development and mining of these materials. It is also an opportunity to share awareness of advances in both technology and production. The result is a better understanding of changing demands across global markets.

In addition we recognize that nothing we do takes place in a vacuum. We live and work in the communities across the globe that are affected by exploration, mining, industry and agriculture. All we do must be done in ways that take into account our neighbors, and our environment – ever mindful of both the successes and mistakes in our past – and focused on a sustainable future. To do this we must listen and learn, but more than that, put to work what we have learned. In this way, we move forward the science and art of the mining industry, seeing ourselves, our communities, and our industries into the foreseeable future.
## 2015 COMMITTEE MEMBERS

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<th>Organization</th>
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<td>Keith Beriswill</td>
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<td>Exhibit Chair</td>
<td>Jama Abbott</td>
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<td>Field Trip Chair</td>
<td>Marc Hurst</td>
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<td>Geology-Exploration &amp; Mine Planning</td>
<td>Joseph E. Crawford</td>
<td>Georgia Pacific Gypsum, LLC</td>
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<td>Clayton McMillan</td>
<td>CEMEX USA Inc.</td>
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<td>Steve Reid</td>
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<td>Analytical &amp; Regulatory Matters</td>
<td>Trish Walsh</td>
<td>Jacobs / Assoc. of Fertilizer and Phosphate</td>
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<td>Jan Miller</td>
<td>University of Utah</td>
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It was a great 2014/2015 year.

On behalf of the officers, staff and members of the Society for Mining, Metallurgy & Exploration (SME), thank you for your past, present and continuing support. The SME has an ongoing commitment to maximize its research and provide value to our members and improve the image of our industry through Community Outreach programs. These programs are vital to our industry and our communities.

This year our section sponsored a 40X40 booth at the National Science Teachers Association conference November 7, 8, and 9 at the Orlando Convention center. We gave away 1,000 mineral kits with the theme “Minerals your body needs to live” along with minerals for our modern lifestyle. We passed out pro-mining literature and videos. Mining education demonstrations were conducted. Thanks to the 20 or more volunteers! If we teach the teachers to be pro-mining, they will teach the students and parents to be pro-mining.

The Florida SME Academic Awards Program presented 24 awards at the Regional Science Fairs for Hillsborough, Polk and Hardee Counties with an additional four awards to top mining related projects. Special awards of Florida Section of SME were presented to six students at the Florida State Science Fair. Nine scholarships were awarded to top graduated high school seniors pursuing engineering, science or mathematics degrees.

Additionally, MEC supplied all the backboards and display materials for Desoto, Manatee, and Hardee County junior and senior science fair participants. Teacher of the Year and three Mining Ambassador of the Year awards were made to key mining-supportive educators in Desoto, Hardee, Hillsborough and Polk Counties. MEC supported the Florida Association of Science Teachers (FAST) Conference in St. Petersburg where 300 mineral kits, pro-mining literature and lesson materials were distributed to educators from across Florida.
MEC sponsored 65 teachers attending the FIPRI Summer Phosphate Workshop. We also printed and distributed to elementary students 5,000 copies of the pro-mining message workbook “Mining Rocks” and awarded three mini grants to K-12 schools in our mining area to support science education projects. Finally, we awarded the David Gossett Scholarship of $3,000 to Patrick Reeder, a top mining co-op student working at a Florida mine.

If you would like to help us make a difference, we need people like you to donate time, energy and experience in a variety of areas. Together, we will be able to help our communities not only to understand our industry, but to work toward a brighter future with programs in mining related projects and education.

Our volunteers say they feel rewarded many times over for the help they provide in making a difference in the lives of others. To find out more about how you can help, call Todd Parker (863) 944-8466 or email at tparker@arrmaz.com or visit our website at www.flsme.org.
Date: October 6, 2015
Time: 8:00 am – 5:00 pm
Location: Meet in the Sikes Hall Lobby at 7:30 am

In the morning we will visit Mosaic’s Four Corners Mine. We will observe the general stratigraphy and lithology of the Central Florida Phosphate District. Mosaic’s geologists will discuss phosphate geology and mining techniques while we tour a dragline and a pit car.

In the afternoon we will tour the Mosaic Four Corners Phosphate Beneficiation plant, the largest in the industry. It has produced as much as 8.1 million tons of product in one year. Industry experts will discuss the unique nature of the Central Florida Bone Valley ore, and how the Florida industry has remained competitive for well over a century. The process discussion will cover the basis for the process, and how washing, screening, hydraulic classification, and flotation are used to separate the valuable phosphate mineral from gangue clay and sand minerals.

*Transportation, lunch and guidebook will be provided.*
## The SME Florida Section

**Would Like to Thank the Following Sponsors of the 2015 Golf Extravaganza**

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CALENDAR OF EVENTS

Tuesday, October 6

8:00 am – 5:00 pm  Mosaic Field Trip
11:30 am  Golf Extravaganza

Wednesday, October 7

7:30 am – 5:00 pm  Registration  Sikes Hall Lobby
7:30 am – 8:30 am  Exhibits Open  Sikes Hall
8:30 am – 11:30 am  GENERAL SESSION  Hollingsworth Ballroom
   Chairs:
   Todd Parker, AmMaz, Mulberry, FL
   Candace Trimble, IM&AD, Havana, FL
   Harry Vroomen, VP The Fertilizer Institute, Agricultural Economics, An Overview
   Mark Davies, P. G., Cemex Continuous Improvement Manager for Quarry Resources, Cemex’s Community Engagement and the Elements of a Strong Permitting Application
   Peter Jackson, Mosaic VP Operations Potash, Potash Mining, An Overview
   Shannon Gonzales, Flatwoods Consulting Group Inc. Senior Ecologist/Principal, Susan Stephens, Esq., Hopping, Green, and Sams, Co-present, Waters of the United States Rule
   Karen Swager, Mosaic VP Mining Operations Phosphates, An Update on Mosaic Phosphate Mining

11:30 am – Noon  Exhibit Break  Sikes Hall
Noon – 1:30 pm  LUNCHEON  Exhibit Hall West
   Keynote Speaker: Nikhil Trivedi, 2010 SME President
   “SME and Industrial Minerals as a Class of Valuable Natural Resources in the World”

1:30 pm – 4:30 pm  TECHNICAL SESSIONS
   Mineral Processing  Hollingsworth Ballroom A
   Environmental, Health & Safety  Sikes Hall F
   Reclamation  Sikes Hall G

4:30 pm – 6:30 pm  Evening Social  Sikes Hall
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<td>Mining</td>
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<td>11:30 am – Noon</td>
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<td>1:30 pm – 3:15 pm</td>
<td>TECHNICAL SESSIONS</td>
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<td>Geology: Exploration &amp; Mine Planning</td>
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<td>Innovations in Technology</td>
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<td>4:15 pm – 5:00 pm</td>
<td>Door and Grand Prize Drawing</td>
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2016 SAVE THE DATES

APRIL 9
Annual SME Scholarship BBQ

OCTOBER 11
11th Annual SME Golf Extravaganza

OCTOBER 12 – 13
Annual SME Conference
GENERAL SESSION  Hollingsworth Ballroom

Conference & General Session Co-chairs
Todd Parker, FL SME, ArrMaz
Candace Trimble, IM&AD

General Session Panelists
Harry Vroomen, VP The Fertilizer Institute, Agricultural Economics Overview
Peter Jackson, Mosaic VP Operations Potash, Potash Mining Overview
Mark Davies, P. G., Cemex Continuous Improvement Manager for Quarry Resources, Cemex’s Community Engagement and the Elements of a Strong Permitting Application
Shannon Gonzales, Principal, Flatwoods Consulting Group, Inc. and Susan Stephens, Esq., Hopping, Green, and Sams, Co-present
Waters of the United States Rule
Karen Swager, Mosaic VP Mining Operations Phosphates, Update on Mosaic Phosphate Mining

Minerals for Agriculture
This session is intended to provide a professional forum for an open exchange of ideas between participants. Speakers invited to present are experts in geology, mining and land reclamation, production, markets and agricultural minerals. The conference serves as a medium to enhance knowledge regarding the geology, development and mining of agricultural minerals, and to share awareness of advances in technology, and to better understand changing demands across global markets in an ever evolving social and regulatory framework.

LUNCHEON KEYNOTE SPEAKER  Exhibit Hall West

“SME and Industrial Minerals as a Class of Valuable Natural Resources in the World”
Nikhil C. Trivedi, 2010 SME President
TECHNICAL PROGRAM

Wednesday, October 7 Afternoon Hollingsworth Ballroom A

1:30 pm MINERAL PROCESSING

It is a rare mineral product that can go directly to market in a mine-run state, so the field of mineral processing is of vital importance to the industry. This large and diverse area of research and engineering is in rapid change, with many new concepts coming to market, and old ones enjoying new developments. We will explore many of these in this Session, with possible topics ranging from comminution to chemical and physical beneficiation.

Chairs
Jan Miller, University of Utah, Salt Lake City, UT
Lucas Moore, AmMaz, Mulberry, FL

1:30 pm – 2:00 pm Blending Consistent and Predictable Feed to Achieve Improved Operational Efficiency with the Use of Nuclear Elemental Analyzers in the Phosphate Production Process
April Montera, SABIA, Inc., San Diego, CA

A phosphate beneficiation plant in Utah is using isotope-based Prompt Gamma Neutron Activation (PGNA) technology to analyze the entire slurry streams of the incoming feed and final product in order to adjust the flotation circuits in near real time and optimize the plant output. A phosphate mining operation in Florida is using the same technology on a conveyor belt to by-pass low value feed before the storage silos. By analyzing the entire stream in both processes, the plants have gained greatly improved visibility/control and are able to reduce product variability for improved profitability and product quality. This paper takes a look at both the economics as well as application details and the difference this technology provides the phosphate operations.

2:05 pm – 2:35 pm Steam Injection Fluid Bed Calciners
George Piegols, PotashCorp, Washington, NC

PotashCorp’s North Carolina phosphate ore deposit is buried in a reducing or septic zone. The phosphate ore is calcined to burn off organic materials adhering to rock. Calcination eliminates the need of defoamer in the phosphoric acid plant. The acid produced is a clean green acid. The Dorr Oliver Calciners are configured to burn either pulverized bituminous coal or #6 fuel oil with compressed air used to atomize the oil. In a major innovation, PotashCorp replaced the high price compressed air with low cost steam produced as a byproduct of sulfuric acid generation. Steam injection improves oil dispersion and combustion while reducing demand for plant air. Steam injection tempers hot spots in the calciners, significantly reducing scale build-up.

2:40 pm – 3:15 pm BREAK
(Please visit the exhibitor booths in the Exhibit Hall)
Phosphate rock is very important to the stability of the United States economy as its products are heavily utilized in the agricultural industry. In the 2013 and 2014 production year, the total production of phosphate rock was 31 million short tons at a grade of roughly 62% bone phosphate of lime (BPL). In order to offset the decrease in phosphate production, processing of lower grade ores than previously considered. These lower grade ores contain higher than acceptable levels of MgO which is present in the dolomite \([\text{CaMg(CO}_3\text{)}_2]\). Due to the high MgO content in dolomite it is a very undesirable impurity in phosphate ores. In lower grade ores present in Florida, the dolomite occurs as coarse (+2mm) liberated pebbles. Dolomite can potentially be separated from the apatite without any crushing or grinding by any process that can function at relatively coarse particle sizes. In the low grade ores dolomite and apatite are mostly liberated, however they have very similar densities with apatite slightly denser than dolomite. This makes most density separations very difficult to perform. A low grade phosphate ore from Florida was used that contained dolomite pebbles at a mean density of 2.51 g/cm³, and apatite pebbles with densities ranging from 2.55-2.78 g/cm³. A unique laboratory scale jig was constructed to separate the dolomite from the apatite. This jig was constructed to allow simple adjustments of the effective jigging parameters. This equipment was designed to operate as a batch process with a constant feed particle size of 6.73 x 3.36 mm. The feed particle size was held constant so that other parameters of the jig could be studied. The primary parameters of the study were the pulsation rate and bed depth. This study concluded that the optimal pulsation rate for the operation of the jig was 200 pulses/minute. A lower pulsation rate of 100 pulses/minute failed to complete the separation of dolomite from apatite, and a higher pulsation rate of 300 pulses/minute did not provide any notable improvement of performance over 200 pulses/minute. After the batch trials were completed the jig beds were analyzed and concluded that the majority of separation occurred in the bottom 1 inch (2.5 cm) of the jig bed.

Intrepid Potash – From Face to Field
John Mansanti, Intrepid Potash, Inc., Denver, CO

Intrepid is the only producer of MOP, muriate of potash, in the United States. In addition to MOP, Intrepid produces magnesium sulfate of potash (langbeinite), salt and magnesium chloride. Throughout Intrepid’s operations, it represents a smaller version of the global potash industry in its mining methods, i.e., conventional mines, solution mines and brine recovery operations and its processing methods, i.e., flotation, crystallization and dense media separation. Intrepid recently commissioned a new solution mine in New Mexico which utilized solar evaporation and flotation to make low cost potash. Intrepid supplies the majority of its product to the domestic agricultural and feed markets. This paper will provide an overview of Intrepid that originates at the mine face and ends at the farmer’s field.
A central theme of the mining industry for several decades has been a constant reduction in environmental impact, and an increased focus on human health and safety. The gains made in these areas are numerous and impressive, but the need for relentless effort at continuous improvement remains. This session will explore current concepts in mining technology which positively impact industrial hygiene and safety, and better ways to mine without damaging our water, wildlife, and environment.

Chairs
Erich Dohm, Jacobs Engineering, Lakeland, FL
John Herbert, On Point Associates, Gainesville, FL

1:30 pm – 2:05 pm **Shallow Depressions in the Florida Coastal Plains: Karst and Pseudokarst**
Sam Upchurch and Thomas Scott, SDII Global Corporation, Tampa, FL
Michael Alfieri, Water Resource Associates, LLC, Tampa, FL and
Thomas Dobecki, SDII Global Corporation, Tampa, FL

In Florida, shallow depressions on the land surface are often attributed to sinkhole development. It has become evident that there are potentially seven different mechanisms which can form these depressions in Florida, including: cover-sub-sidence sinkholes; suffosion sinkholes; cover settlement over shallow shell beds; aeolian deflation areas resembling “Carolina bays”; aeolian deflation depressions; depressions that mimic landforms developed on a shallow paleosol; and depressions created by pedodiagenesis in a soil-forming environment. Only the first two appear to represent traditional mechanisms for sinkhole development in karst, while the third is poorly understood and frequently and incorrectly attributed to sinkhole development processes. The last three mechanisms are pseudokarst created by aeolian and soil-forming processes. Proper identification of these features can ease potential permitting issues with regulators in respect to mines/mine expansion.

2:05 pm – 2:35 pm **Improving Driving Behaviors and Reducing Risk through Technology**
J Kirby Lastinger, Amec Foster Wheeler, Lakeland, FL

Vehicle accidents are one of the leading causes of injury and death in the United States. Amec Foster Wheeler employees, drive millions of miles a year. We have identified that driving is one of the most hazardous activities that most of our employees perform regularly, and to reduce that risks we have implemented the DriveCam program companywide over the past year. By properly managing the program which includes coaching risky drivers, providing remedial driver training, and when needed using progressive discipline to create positive changes in driving behaviors, we have seen a profound decrease in risky driving behaviors that lead to accidents, and have significantly improved driver safety.

2:40 pm – 3:15 pm **BREAK**
(Please visit the exhibitor booths in the Exhibit Hall)
3:15 pm – 3:45 pm  **The Safety of Mining Dams, Levees, Reservoirs: Historic Failures of Industrial Embankments and Ways to Ensure Safe Dams in the Future**  
Scott Burch, *Gannett Fleming, Inc.*, Jacksonville, FL

Over 2000 privately held dams in the U.S. are classified as potential high hazard dams. Alarmingly, only 10% of these dams were being remediated. While dam ownership poses risks, proper evaluation, analysis, and management allows these risks to be safely managed. Two dam failure case studies will be examined: the Florida Power and Light cooling pond that failed due to internal erosion and the TVA’s Kingston Fossil Plant failure that caused millions of dollars of damage. Fortunately, there are relatively straight-forward risk reduction measures and processes that can be implemented to assess the integrity of dams, identify potential failure modes, and prepare Emergency Action Plans. When remediation is necessary, recent advances in construction technology can provide innovative, cost effective solutions to dam safety issues.

3:45 pm – 4:15 pm  **Confined Space in Construction**  
Joan Spencer, *OSHA, Tampa, FL*

The new Confined Space in Construction standard went into effect on August 3, 2015. It applies to manholes, crawl spaces, tanks and other confined spaces not intended for continuous occupancy that are located on construction projects. Confined spaces are defined as those that (1) are large enough for an employee to enter; (2) have limited means of entry or exit; and (3) are not designed for continuous occupancy. The rule provides construction workers in confined spaces with the same protections already afforded to workers in manufacturing and general industry but differs in several construction-specific respects. The presentation will cover the implementation of the OSHA standard.
A basic precept of the modern mining industry is to “Do No Harm.” That is, to temporarily use the land, but after mining is completed, to return it to a state as good as, or better, than before mining started. Such a belief and practice is an enormous challenge, and one which is being met successfully. Restoring a mined area to a useful and aesthetically pleasing state calls for the efforts of a wide range of professionals, from geologists and hydrologists, to civil engineers, agronomists, botanists and zoologists. Papers in this session will cover challenges and successes in this area.

**Chairs**
Will Griffin, *Golder, Atlanta, GA*
Eric Michel, *Mosaic, Mulberry, FL*

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**1:30 pm – 2:05 pm**

**Streamsong: A Unique Take on Reclamation**  
*Matthew Wozniak, MOSAIC, Lithia, FL*

A model for economic and environmental sustainability, Streamsong has developed into a world class resort, and a distinctive example of the possibilities for post mining land use. The dramatic elevation changes left behind from mining phosphate formed the foundation upon which the golf courses, Streamsong Red and Blue, were built. This presentation will review the history of the site and some of the challenges encountered while transforming a post mining landscape into a golfer’s dream destination.

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**2:05 pm – 2:35 pm**

**Archie Creek: Adaptive Management in the Changing Landscape of Phosphate Mining**  
*Clayton Robertson, VHB, Bradenton, FL*
*Sean Murray, VHB, Bradenton, FL*

The expansion of the Mosaic Riverview Plant Phosphogypsum Stack resulted in the relocation of Archie Creek and the restoration of a viable system which required creating stream habitat compatible with the area hydrology and adjacent natural communities. Subsequent to the construction of Archie Creek and associated mitigation wetlands, it was agreed the water level in the North Mitigation Area was too high to support establishment of a forested wetland. VHB reviewed the project site and identified several constructed areas which could support wetland tree species. These areas were then planted to meet permit requirements, and three years later the permitting agencies determined tree survival was sufficient to declare success and release Mosaic from all monitoring requirements.

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**2:40 pm – 3:15 pm**

**BREAK**  
(Please visit the exhibitor booths in the Exhibit Hall)
3:15 pm – 3:45 pm  **Invasive Species Control and Mine Reclamation Site**  
Brent Sellers, *University of Florida, Ona, FL*

Invasive species as a whole are a major detriment to society causing billions of dollars of damage annually to many ecosystems. Furthermore, invasive plant management is a major contributor to reclamation costs on mined lands. Biology and management techniques for invasive grasses such as cogongrass, West Indian marsh grass, smutgrass, natalgrass, and torpedograss will be discussed. Additionally, management techniques for broadleaved species such as Caesar’s weed, Brazilian peppertree, Chinese tallow, and lantana will be provided. While effective herbicides have been available for these species, a recent new active ingredient, aminocyclopyrachlor, has been found to be effecting in control of many broadleaved plants and brush. Discussion of recent research with this herbicide will be presented.

3:45 pm – 4:15 pm  **Mining in Society**  
Aleta Mitchell-Tapping, *CEMEX, Davenport, FL*  
Jenna Emerson, *CEMEX, Orlando, FL*

How does mining contribute to society? We can all look around and see the items produced by this industry, but we neglect to champion the learning opportunities it provides. CEMEX has been at the forefront of education in our communities by providing unique learning opportunities at our sites. Both internal and external industry professionals collaborate with educators to provide a hands-on learning experience for students in our on-site classrooms. Through this partnership, the importance of providing educators with a thorough understanding of the mining process has been recognized.
- Land Surveying
- Hydrographic Surveying
- 3D Scanning & Modeling
- Underground Utilities & Geophysics
- Geographic Information Systems (GIS)

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MINING

Once the mineral deposit has been located, mapped, and characterized, it remains just an interesting mineral occurrence until the mine is designed and opened. Mining is the process of going from lines on paper to rock in the box. The session on Mining will present papers exploring challenges faced by the mining operation, current and new approaches and technologies for winning mineral wealth while protecting people and the environment.

Chairs
Justine Goll, Mosaic, Mulberry, FL
Steve Reid, Mosaic, Mulberry, FL

Caliper Disc Brake Technology in Mining
Edward Conway, SMI Corporation, Douglasville, PA

Caliper Disc Brakes have had a significant impact in the mining industry. Through the years the SMI Corporation has developed and designed a complete line of Caliper Brake System that address the high demand of dragline and shovel applications. The design advantages of our system make them the best performing brake system on the market today, with the lowest cost of maintenance and ownership. Their unwavering reliability dramatically reduces downtime, allowing you to maximize your production without interruption. The SMI Caliper Brake System will easily exceed motor stall torque test, provide reliable and smooth braking during operation, and will dissipate any heat due to loss of excitation without the need to adjust or change the friction material.

Product Design for Production and Maintenance Optimization
Armond Groves, AMSCO Wear Products, Inc., Nashville, TN

Bucket rigging plays a major role in optimization of dragline mining. By listening to the key stake holders in the mining organization (operators, maintenance, production and management,) it is possible to have a significant impact on production and maintenance efficiency, reliability and the cost. AMSCO is striving to help our customers reach their targets by: reduction of annual bucket maintenance cost by extending the life cycle of the bucket rigging, reduction of spare inventory requirements by offering standardized solutions that don’t compromise individual user satisfaction and tailoring product design for specific digging and maintenance needs. AMSCO believes that an effective supplier must do as much as possible to understand the challenges that its customers are facing. By placing a focus regular communication, field presence and willingness to provide a customized solution, we have been able to meet the specific needs of our customers.
The mining of the S1 Clay Settling area involved the extensive effort of Mosaic’s mines planning, permitting, geo-tech, operations and reclamation teams over a 10-year period. The successful mining of this area required dredging of consolidated clays in the clay settling area, a long distance relocation of the dragline and mining infrastructure, an innovative mining strategy for the area, disciplined execution of the mine plan by operations, and diligent reclamation work to complete the mining life cycle.
8:30 am  CHEMICAL PROCESSING

Many mined products require additional chemical processing to produce marketable commodities. Nowhere is this more apparent than in the phosphate industry, in which onward processing is where much value is added. This session will explore current and novel practices in chemical processing, and address associated issues that present challenges to the industry. New reagents, and the regulatory response to such changes, will be examined.

Chairs
Britney Cooley, MOSAIC, Mulberry, FL

8:30 am – 9:05 am  Jacobs’ New Process for Removing Iron from Phosphoric Acid
Stephen Hilakos, Jacobs Engineering Group, Inc., Lakeland, FL

Jacobs has developed a technique for removing iron from phosphoric acid. Additional details and the latest results are will be available for presentation at the conference. With the new process, Jacobs has successfully treated high iron acids and reduced minor element ratios (MERs) by over 50% with only a minor loss of P2O5 content. The new process should be attractive in regions with phosphate deposits that contain high concentrations of iron, such as those located in Australia, Canada, Northern Africa and areas of the Middle East.

9:10 am – 9:45 am  Suitability of Geoscan-M Elemental Analysis for Phosphate Rock Processing
Henry Kurth, Scantech International Pty Ltd., Springwood, QLD, Australia

Geoscan-M performs real time elemental analysis of conveyed bulk materials using prompt gamma neutron activation to ensure fully transmissive, continuous analysis unaffected by particle size, mineralogy, belt speed and dust. Geoscan-M has proven safety, operational performance and reliability, and demonstrated remarkably short paybacks in various mineral industries including North African and USA phosphate operations which have successfully evaluated and adopted the technology. Applications in phosphate processing are in measurement of mine feed to the beneficiation plant, bulk sorting of unloaded rail cars of phosphate rock onto appropriate stockpiles, blending reclaimed rock for plant feed, and acid digestion control. Additional benefits include a significant reduction in routine sampling and laboratory analysis. Moisture analyser and belt scale inputs allow for tonnage weighted dry weight percent reporting.
Improved Performance with Split Flow Gas-Gas Heat Exchangers
Kim Nikolaisen, Andreas Mahecha-Botero and C Guy Cooper,
NORAM Engineering and Constructors Ltd., Vancouver, BC, Canada

The benefits of radial flow gas-gas heat exchangers for the large volumetric flows encountered in sulphuric acid plants are well known in the industry. A sub-category of the radial flow gas exchangers is the Split Flow gas-gas heat exchanger. The Split Flow design has proven to be an effective way to reduce maintenance, improve life time and performance in several services. The patented Split Flow (SF™) gas-gas heat exchanger design splits the gas to one side of the exchanger into two parts. One part is used to sweep the "troubled" tube sheet and eliminate the operational problems that otherwise show up here.

The concept has been used in three types of gas exchangers: 1) cold exchangers, 2) preheaters and 3) SO3 coolers. In cold exchangers a “hot sweep” reduces sulphate fouling from acid condensation at the cold tube sheet, in preheaters a “cold sweep” reduces the hot end metal temperature and results in improved energy efficiency, and in the SO3 coolers a “hot sweep” eliminates acid condensation and potential for hazardous SO3 sublimation at the cold end. This paper describes important design aspects of the Split Flow gas-gas heat exchangers to better understand the advantages and limitations as compared to conventional equipment designs. Case studies will be given to show the improvements to the plant operations after the installation of Split Flow gas-gas heat exchangers.

Introduction to the WTP Double Circulation Phosphoric Acid Production Technology
Joseph Zhu, Wellthought Products, Inc., Jacksonville, FL

In the wet process phosphoric acid production, the byproduct phosphogypsum has become a worldwide environmental and in some cases geological hazard. For some production sites, the phosphogypsum piles have become very difficult and costly to use and maintain. On the other hand, it is also recognized that the situation is becoming more dire as good deposits are being depleted. As a result, the process efficiency will undoubtedly suffer even more. The WTP Double Circulation technology has been developed to combat the situation. The double circulation of slurries enables the rock digestion and sulfuric acid mixing to be independently optimized and immensely reduces the gypsum supersaturation. The digestion and separation efficiencies are significantly improved.
This session is at the heart of the Conference: Where the rubber meets the road, or, more aptly, where the minerals meet the roots of the plants. Topics will include principal sources and use of agricultural minerals, including how plants and animals use the nutrients supplied by the minerals. Of equal interest are issues and challenges involving production volumes, transportation to markets, and current and foreseen market trends.

Chairs
Joan Kyle, Nutrients for Life Foundation, New Smyrna Beach, FL
Candace Trimble, Havana, FL

**8:30 am – 9:05 am**
**Improved Geophysical Imaging Using the Multi-Electrode Resistivity Implant Technique (MERIT) Case Studies in Florida**
David Harro, G3 Group, Odessa, FL and Henok Kiflu
Sarah Kruse, University of South Florida, Tampa, FL

The Multi-Electrode Resistivity Implant Technique (MERIT) involves rapid installation of parallel surface and buried arrays of electrical resistivity electrodes. Implanting, deep electrodes increases the depth of investigation of a resistivity survey by a factor of two, effectively decreasing the required array length by one-half and enhancing resolution capabilities of electrical resistivity tomography at depth. This paper will focus on case studies performed using this technique.

**9:10 am – 9:45 am**
**New Technology for HDPE Pipelines in the Phosphate Mining Industry**
Andy Niblett, ISCO Industries, Louisville, KY

Remote mining locations often create significant challenges in the cost-effective procurement of HDPE pipe for demanding phosphate mine application. This discussion will focus on an exciting new technology by which high performance polyethylene pipe may be manufactured on-site at or in very close proximity to the mine property. The features and benefits of this unique supply alternative will be thoroughly discussed along with project considerations such as site and logistics requirements. The presentation will then conclude with a brief review of some recent installations that utilized this innovative technology.
The importance of potash for both plants and human growth is well established. Unfortunately there are no potash resources like sylvite, carnallite or polyhalite in agricultural based country such as India. Therefore, India is meeting complete potash demand through import. An attempt has been made to extract potassium (K) values from silicate rocks like nephelene syenite, glauconite, feldspar and mica. Extensive characterization studies revealed that the sample contains orthoclase, nepheline and biotite as major potassium bearing mineral phases and K is locked in the host matrix. These rocks contain ~5-10% K2O were subjected to different physical and chemical beneficiation processing and recovered only 10-12% values. Finally, a roast leach method using chloride salt followed by water leaching extracted about 85-99% K values at optimum conditions.

Agriculture in the future is dependent on mining firms improving operational efficiency, phosphorus recovery and process automation. Increasing global food demands will require improved agricultural yields … period. This will have a direct impact on mining best practices where phosphorous recovery and lengthening mine life are critically linked to the agricultural demands that will be placed on the phosphorus mining industry of the future. The application of On-line Nuclear Magnetic Resonance (NMR) Technology in the phosphate industry can address the critical need to improve phosphorous recovery and improve phosphate mining and beneficiation operations. This presentation will discuss how monitoring the P2O5 (BPL) concentration at key points within the phosphate beneficiation process can improve phosphorus recovery, reduce production costs, increase production capacity, improve the operation of the plant overall and extend the life of the mine. By continuously monitoring P2O5 recovery it can be determined which process variables result in the most improvement. Coupled with automated DCS process control current and future facilities can optimize themselves allowing workers to focus on other critical mine tasks.
We live in a time of remarkably rapid technological innovation, the mining industry no less than any other. In fact, to fail to innovate is to fail completely. In this session we will explore new ideas and new applications in all areas of the mining industry. We will consider, as well, the issues and challenges brought about by these innovations. In fact, some innovations arise in response to the challenges created by other technical innovations. The key to this session will be free and unfettered creative thinking.

Chairs
Patrick Zhang, *Florida Polytechnic University, Lakeland, FL*
Regis Stana, *R Squared S, Lakeland, FL*

1:30 pm – 2:00 pm **Application of Classification and Fluidized-bed Flotation at PCS Aurora**
George Piegols, *PotashCorp, Washington, NC*

Classification and coarse flotation circuits were recently added to the phosphate beneficiation plant at PotashCorp, Phosphate Division’s, Aurora mine. The original plant flow sheet was designed to treat 2,020 t/h (2,220 stph) of phosphate matrix ore and generally yielded an overall P2O5 recovery of 79% using conventional, mechanical flotation cells. Size-by-size results indicated that the recovery of the coarse component (+0.425 mm) was very poor. To improve the coarse particle recovery, a classification circuit was added to the plant which created both a fine and coarse feed. While the fine feed is now treated in the existing conventional cells, the coarse feed was routed to fluidized-bed flotation units (i.e., HydroFloat Separators). Laboratory- and pilot-scale tests had been carried out to determine the benefits of this approach which included higher recovery, reduced reagent consumption, and an attractive return on investment. Current plant data indicate that the split-feed flotation circuit has increased recovery and provides results consistent with the earlier test work. In addition, this split feed flotation circuit provides added flexibility for plant personnel to meet various production requirements.

2:05 pm – 2:35 pm **The Extraction and Recovery of Rare Earth Elements from Phosphate Using MX-107 and Chelok Polymers**
Joseph Laurino, *Periodic Products Inc., Fort Lauderdale, FL*

The extraction and recovery of REEs from phosphate rock and three phosphate waste by-products using an aqueous-based extraction solution and an adsorption polymer, poly 1-octadecene 2,5-furandione salt, are examined. Overall extraction and recovery yields were between 80% for gadolinium and 8% for praseodymium from amine tailings, 70% for terbium and 7% for praseodymium from phosphogypsum, 56% for scandium and 15% for praseodymium from phosphate rock, and 77% for samarium and 31% for praseodymium from waste clay. The polymer effectively bound 100% of the REEs extracted from the solids. This process may be an efficient means of recovering REEs from phosphate mining waste products. Treatment of phosphogypsum stack water and leachate with poly 1-octadecene 2,5-furandione salt may effectively reduce metal contamination of both surface and groundwater.
2:40 pm – 3:15 pm  **Cleaner Tails Recycling to Minimize Phosphate Loss**  
Aaron Fallaw, Lucas Moore, Guoxin Wang, James Gu, Yu (Ryan) Xiong  
Steve Dobson, ArrMaz, Mulberry, FL

As ores degrade, mining techniques and chemistries change to meet market demand and maintain product quality. The balance of recovery and grade is a significant challenge in the Crago Process where a collector is used to float phosphate, followed by acid scrubbing, then an amine float to improve product grade. As grade is a requirement for DAP and MAP production, recovery is the criteria to suffer. Phosphate losses in the amine float can bring overall recovery down by as much as 18%, creating a growing need to think outside the box to improve recovery. This paper will focus on the theory of amine tail recycling and the best methods to optimize the overall phosphate recovery by recycling the tails from the cleaner flotation step.

3:15 pm – 3:35 pm **BREAK**  
(Please visit the exhibitor booths in the Exhibit Hall)

3:35 pm – 4:05 pm  **Recovery of Rare Earths from Florida Phosphate: Challenges and Opportunities**  
Patrick Zhang and Haijun Liang, FIPR Institute, Bartow, FL  
David DePaoli and Laetitia Delmau, Oak Ridge National Laboratory, Oak Ridge, TN

Rare earth elements (REEs) are critical to national security, green energy development and technological advance. US phosphate is a significant secondary source of REEs. If these REEs are recovered from phosphate processing, they can meet 180% of the current world demand for yttrium and 130% for dysprosium. In Florida phosphate mining and processing, REEs are distributed in four major streams: waste clay, amine flotation tails, phosphoric acid, and phosphogypsum. Recovery of REEs from these streams is challenging for two main reasons: 1) REE concentration in any of the streams is very low thus demanding high consumption of extracting reagents; 2) phosphogypsum is subject to EPA regulations. However, since joining the Critical Materials Institute (CMI) in July 2013, FIPR, in collaboration with ORNL, has developed several methods for upgrading and extracting REE from all the four streams achieving some promising results.
1:30 pm GEOMULTI-EXPLORATION & MINE PLANNING

The 2015 SME Florida and Dreyer Conference is an international forum for the direct exchange of information related to economics, technologies, engineering/geosciences, and environmental activities associated with the mining of Agricultural Minerals. The Geology, Exploration & Mine Planning session is devoted to relevant communications on the following topics:

- General understanding of minerals and mineral deposits important to agriculture
- New projects and mineral discoveries
- Exploration methods and technology
- Advances in mine planning and resource modeling
- Impacts of geology and hydrogeology on mining systems

Chairs
Joseph Crawford, Georgia Pacific Gypsum LLC, Port Saint Lucie, FL
Clayton McMillan, CEMEX, Davenport, FL

1:30 pm – 2:00 pm Strategies for Optimizing Minerals Drilling Projects
Joseph Crawford, Georgia Pacific Gypsum LLC, Port Saint Lucie, FL

Assessment drilling is fundamental practice for mineral exploration and reducing operating risk exposure. This presentation focuses on program planning, drilling methods and interpretive techniques to get the best value for capex spending. Drilling costs on a unit basis have increased by 20% to 30% over the last 30 years, but the range of available technologies and services has expanded with advances in borehole logging, interpretive approaches, and rotosonic applications. It is the proper application of these technologies that can enhance the quality of acquired geological data and reduce risk. Examples are given from the potash industry and other commodities.

2:05 pm – 2:35 pm Role of Multi-Channel Analysis of Surface Waves MASW in Evaluating Limestone Deposits, Tailing Dams, and Levees
Fredric Pirkle, Gannett Fleming Inc., Jacksonville, FL
Richard Lee, Quantum Geophysics Division Gannett Fleming Inc., Phoenixville, PA

Multi-Channel Analysis of Surface Waves (MASW) is a seismic surface wave method that is an efficient, easy to deploy, non-invasive, non-destructive, continuous profiling method that identifies subsurface conditions based upon differences in shear wave velocities (Vs). Vs are a measure of material stiffness similar to N-values from SPT borings. Higher Vs indicate stiffer materials. No other geophysical method measures a parameter directly related to material stiffness. MASW can identify top of rock, differentiate between weathered rock and competent rock, and evaluate the continuity of rock layers and the structural integrity of dams and levees. It can detect small, unpredictable features that might otherwise be straddled by borings. These features can include zones of less stiff materials in the levee body and the foundation materials.
Advances in Technologies and Techniques in Mapping Mine Sites
Craig Emrick, Pickett & Associates Inc., Bartow, FL
Sherry Grymko, Pickett & Associates Inc., Bartow, FL

Technology within the field of surveying and mapping is advancing faster than ever. Traditional photogrammetric mapping, and hydro surveys using lead weights, were the advanced techniques of the past. While there still might be a time and place for those techniques, aerial LiDAR with digital imagery, and multibeam hydrographic surveys are the advanced technologies used today. As regulations, accounting and safety become more strict in mining operations, these advances in surveying and mapping allow managers to be more precise and efficient. The merge of these data into one comprehensive mapping product provides an extensive amount of information for engineering and planning purposes. This presentation will conclude by touching on the future of mapping using unmanned aerial vehicles (UAV) as the platform for data collection sensors.

BREAK
(Please visit the exhibitor booths in the Exhibit Hall)

UAV Technology to Improve Efficiency in Mining and Agriculture
Bryan Franker, Prioria Robotics Inc., Gainesville, FL

As the UAV industry expands, and FAA standards are updated, Prioria is pioneering the use of Unmanned Aerial Vehicles and embedded technology in the mining industry. The ability to collect data quickly and easily using UAVs indicates great potential to be more effective than traditional data-collection methods such as manned aircraft, satellite imagery, or ground-based surveys. Not only are UAV’s proving to be more effective than traditional methods, but they are also safer and generally less expensive to operate. There are many varied applications within the umbrella of the mining industry, including Mapping, Volume Calculations, Infrastructure Inspection, Risk Mitigation Methods, Emergency Response and others. Attendees should walk away from this presentation with a better understanding of the capability of UAV’s and how they can help increase productivity in operations.
1:30 pm  ANALYTICAL & REGULATORY MATTERS

The Analytical & Regulatory Session will introduce a range of topics on the evaluation of analytical analysis and of regulatory rules and rulemaking issues for Agricultural Minerals. As the World’s population continues to grow, the demand for agricultural mineral resources increases, which brings about a need for an evolution in analytical methods to cope with impurities in these resources and their production. Ever-improving analytical technology and regulations for laboratories are topics of interest to this Conference, and will be discussed during this session.

Chairs
Trish Walsh, Jacobs / Assoc. of Fertilizer and Phosphate Chemists, Lakeland, FL

1:30 pm – 2:00 pm  A Rapid Non-Destructive Rapid Analysis Tool for the Phosphate and Fertilizer Industries
Stephen Medlin and John Richmond, Bruker, The Woodlands, TX
Sanford Siegel, Mosaic Fertilizer, Plant City, FL

Nitrogen and phosphorous are essential plant nutrients for plant development. Accurate measurement of nitrogen and phosphorous concentrations are essential to deliver the correct amount to fields. Current methods for measuring phosphorous and nitrogen are destructive, time consuming and complex techniques. We present here a rapid (20 seconds) non-destructive analytical tool using a Bruker FT-NIR spectrometer. The FT-NIR can measure multiple properties with no sample preparation. We can measure with comparable accuracy and precision that is 1.5X the SD of the primary method for Nitrogen, P2O5 and other components. This paper presents a spectroscopic solution to ensure accurate agricultural mineral delivery.

2:05 pm – 2:35 pm  Phosphate Fertilizers – The Challenges Associated with Determining its Quality
Hugh Rodrigues, Thornton Laboratories Testing Inspection Services Inc., Tampa, FL

Phosphorous – one of the building blocks of life – is in the forefront of the push to feed the projected increase in the worlds’ population. The known reserves of phosphate ore are being exploited to their maximum and newer sources e.g., marine deposits are being assessed. Issues with the analytical methodologies used to determine the quality of the products being traded have been noted and a concerted effort is being made to harmonize existing methodologies by various groups- IFA, ISO, AFPC- and also to develop and publish improved methods. This presentation will discuss the challenges associated with harmonization of existing methods, and method development.
Magnetic Resonance (MR) Sensors for use in Phosphate Process Analytics
Vaughn Davis, Flash Analysis, Rapid City, SD

Magnetic Resonance (MR) has been in industrial use for over 25 years. When applied well, MR technology is capable of improving efficiencies and recovery in the phosphate value chain. MR is commonly employed for Magnetic Resonance Imaging (MRI), drug discovery, organo-metallic analytics and in petrochemical and industrial process control applications. Some of the most frequently observed nuclei are 1H, 13C, 19F, 9Li, and 31P. With new developments in magnet manufacturing and materials of construction, a particular magnet setup can be tailored for a specific process application while using identical software and spectrometers for each application. Most phosphate applications are for 31P and 19F in rock feed, beneficiation processing, phosphoric acid and fertilizer. Newer, larger-bore sensors have the ability to measure an increased sample size while smaller magnets allow for continuous measurement of liquid acid streams. Sensors are nearly always paired with a representative sampling system to provide the most accurate results.

3:15 pm – 3:35 pm BREAK
(Please visit the exhibitor booths in the Exhibit Hall)

3:35 pm – 4:05 pm A New Dynamic Image Analysis Method to Detect the Particle Size and Shape of Minerals for Agriculture
Gert Beckmann, Retsch Technology GbmH Verder Scientific HORIBA, Haan, Germany

The basic principles of Dynamic Image Analysis will be discussed as they relate to typical particles. These principles will be illustrated with real particles and this data compared and contrasted to that of sieve results as well as laser diffraction analyses. These results will be used to illustrate the power of combining particle shape along with the more traditional particle size distribution. The examples will encompass sample analysis in the laboratory, at-line and also on-line in a process. These examples will be extended to the fertilizer industry for materials such as potash, nitrogen and also phosphate fertilizers. For these materials, crucial parameters such as proper sampling techniques and sample preparation will be highlighted. The data from a properly designed experiment will then be compared to more traditional measurements used in the fertilizer industry. The ability to create reproducible data over a series of mine locations will also be presented.

DON’T FORGET
Professional Development Hours forms may be turned in at the Registration Booth through the end of the conference.
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Contact Information: Keith Beriswill, PE
keith.beriswill@amecfw.com
Amecfw.com
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Contact Information: Todd Parker
TParker@arrmaz.com
863-578-1279
arrmaz.com

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Nadim F. Fuleihan, Sc.D., PE
8008 S. Orange Ave., Orlando, FL 32809
407-855-3860
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Contact Information:  
David Bulluck, Manager, Business Development  
david.bulluck@dcreng.com  
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Office: 813-418-3340 x 312  
Direct: 813-574-6180  
Cell: 813-390-0147  
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813-600-5747  
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Tammie Jurnigan or Keyland Amig, Account Manager Sales  
GLI@GLIEARTH.com  
Cell 863-581-5122  
Office 863-767-0290 ext 206  
Fax 863-767-0517  
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andy.niblett@isco-pipe.com
ISCO Industries, Inc.
926 Baxter Ave. Louisville, KY 40204
Cell: 813-690-2179
Office: 502-318-6762
isco-pipe.com

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Contact Information:  David J. O’Brien Jr. PSM
doebrien@survtechsolutions.com
SurvTech Solutions, Inc.
10220 U.S. Highway 92 East, Tampa, Florida 33610
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Contact Information:  xylem.com/dewatering/us
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Custom Drilling Services, Inc.
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Contact Information: Fredric L. Pirkle, P.G., Ph.D., Principal Geologist
fpirkle@gfnet.com
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Ed Murawski, Program Manager  
3919 Riga Blvd., Tampa, FL 33619  
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<table>
<thead>
<tr>
<th>Year</th>
<th>SME/AIME</th>
<th>FAPG-AIPG</th>
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<td>Nick Katzaras</td>
<td>Allen T. Truestell</td>
<td>Dave Sabatino</td>
<td>Dennis Sebastian</td>
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<td>2013</td>
<td>Reab Berry</td>
<td>Marc Hurst</td>
<td>Andrea Williams</td>
<td>Hugh Rodrigues</td>
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<td>James P. Morris</td>
<td>Sam Upchurch</td>
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<td>Paul Clifford</td>
<td>Tom Abel</td>
<td>Paul S. Waters</td>
<td>Sanford Siegel</td>
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<td>Don Tompkins</td>
<td>Curt Simmons</td>
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<td>2009</td>
<td>R.C. Albritton</td>
<td>Joe Alex III</td>
<td>Robert W. Andrew</td>
<td>Lovie Hudson</td>
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<td>David Gossett</td>
<td>Bonnie Dodson</td>
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<td>Ronald Hartung</td>
<td>Wink Winkle</td>
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<td>Edmund Finch</td>
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<td>Colin Campbell</td>
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<td>Dave Raden - General Chair</td>
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22: 2007 - 22nd
23: 2008 - 23rd
24: 2009 - 24th
25: 2010 - 25th
26: 2011 - 26th
27: 2012 - 27th
28: 2013 - 28th
29: 2014 - 29th
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