

TRIP REPORT

22nd World Mining Congress and Expo

11-16 September 2011, Istanbul, Turkey



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September 2011

Details of Person visited:

- **Dr. Agus Pulung Sasmito**, research engineer under M3TC and Department of Chemical and Bio-molecular Engineering.

Purpose:

- To present a paper entitled “Improved total air-conditioning system in underground coal mines - A computational study” by A.P. Sasmito, E. Birgersson, H. Ly, K.W. Lum and A.S. Mujumdar.
- To network with industrial as well as academician in the mining related area.

Schedule of the trip

Date	Time	Activity
11 September 2011	17.00 – 22.00	Registration and welcome cocktail
12 September 2011	09.00 – 10.00	Welcome speech <ul style="list-style-type: none"> • Rifat KONT – Chairman of 22 WMC & Expo • Prof. Sinasi ESKIKAYA – Scientific committee of 22 WMC & Expo • Prof. Dr. Dubinski, Chairman-WMC
	10.00 – 13.00	Keynote lectures <ul style="list-style-type: none"> • Mr.Iain ANDERSON, GM Çayeli Copper Co. GOLDEN SPONSOR • Dr. Atiq SEDIQI, Director of AFGHAN Geological Survey • H. E. Sri Prakash JAISWAL, Minister of Coal-INDIA • H. E. Taner YILDIZ, Minister of Energy and Natural Resources • W. XIANZHENG, Chairman-China Coal
	13.00 – 15.00	Keynote lectures <ul style="list-style-type: none"> • Prof Ajoy K Ghose, International Organizing Committee of World Mining Congress • Prof T Ozuslu, Chamber of the Mining Engineers Turkey • Prof M Kuyumcu, LMBV mbH, Germany • Prof P.N. Marten, RWTH Aachen, Germany • Prof G. Onal, Istanbul Technical University, Turkey
	15.00 – 17.00	Visit mining Expo
	19.00 – 21.00	Gala dinner
13 September 2011	09.00 – 12.00	Keynote lectures <ul style="list-style-type: none"> • Prof H Ehnes, ISSA Mining Industry, Switzerland, Germany • Prof E Ricketts, EURACOAL, Brussel, Belgium • Prof Hebestreit, Euromines • Prof T. Winkler, KOMAG Institute of Mining Technology, Poland • Prof C. Drebenstedt, TU Berakademie Freiberg, Germany
	13.00 – 17.00	Academic session

	19.00 – 21.00	Bosphorous dinner
14 September 2011	09.00 – 12.00	Academic session
	10.00 – 10.30	Paper presentation
	13.00 – 17.00	Academic session
	19.00 – 21.00	Gala dinner
15 September 2011	09.00 – 12.00	Academic session
	13.00 – 17.00	Academic session
	19.00 – 21.00	Banquet dinner
16 September 2011	09.00 – 12.00	Academic session
	13.00 – 15.00	Istanbul declaration, closing and preparation for 23 rd World Mining Congress 2013 in Montreal Canada

Global perspective in mining industries

- Turkish mines – an overview:* In Turkey, the mineral exploration and mining facilities for metals and raw materials dates back to ancient times, nearly 60 types of minerals have been produced. Turkey is in the 10th place throughout the world according to mineral variety and 28th for its production of underground resources of 132 countries. Only 13 of all the 90 minerals traded all over the world do not exist in Turkey. These minerals do not have enough quality and quantity to be exploited. 50 types of minerals are found adequately but 27 types of minerals lack the desired quality and reserves for exploration. Boron is the most abundant mineral and Turkey has 72% of all the world reserves. In addition to its boron potential; trona, salt, sodium sulphate, perlite, pumice, feldspar, bentonite, barite, magnesite, sepiolite, strontium salts, zeolite, sepiolite, marble and quartz, grindstone, bauxite, chrome and lignite are the other important minerals in Turkey. Moreover, Turkey has 2.5% of the industrial raw material, 1% of the coal and 0.8% of the geothermal and 0.4% of the metallic mineral reserves of the world. Turkey also has a significant potential for natural stone. It holds the 30% of known natural stone reserves of the world. Marble, granite and travertine are all currently being exploited in Turkey (3.8 billion m³ marble, 2.7 billion m³ travertine and 995 million m³ granite).
- Coal mines in China:* China has abundant coal resource and a complete assortment of coal. It is widely distributed in China but not evenly. The coal-formation time is long and lots of coal forming period existed. China has a relatively complex geological condition. China has a 600,000 km² coal reserve area and total coal deposits of 5,568 billion tons which are as deep as 2,000 vertical meters. China has 1400 Bt demonstrated coal reserves, accounting for 94% of fossil energy reserves. Most of the coal reserves distribute in the north, the northwest and southwest of China. The annual coal production in China increased from 2.349 billion tons in 2005 to 3.24 billion tons in 2010, increases 891 million tons, the annual increase is 178 million tons, and the accumulative production of this 5 year is 16.045 billion tons. The annual coal consumption of coal in China accounts for 46.9% of world, and production accounts for 45% ranking No.1 in the world for several years.
- Energy challenges in India and SAARC nations:* Availability of adequate and affordable quality energy services will dictate the growth trajectory of the nations under SAARC, which is a powerful block of emerging economies. The daunting challenges that SAARC nations face and presents an overview of dominant energy issues including rational choice of fuels and

the emerging energy landscape. Selectively, the energy perspectives of India, Bangladesh and Bhutan are scanned under the energy lens to highlight the need for avoidance of fuel wood use, focus on higher investment in hydropower and nuclear energy, exploration for natural gas and oil and alternative energies. The uses of IT for smart grids, increasing recourse to renewable energies are also highlighted and the creation of an integrated power grid system to address power deficit in South Asian countries are recommended.

- *Surface mine reclamation in Germany:* The restructuring process of the mining industry in former East Germany after German reunification is important for German economic development as well as for environment and society. Remediation of around 100,000 hectares of mining area, and restoration of an extensively self-regulating water balance over a surface area of approx. 39,000 hectares, involved the largest single landscape construction site in Europe. It has been possible, as part of fulfilling mining remediation tasks, to harmoniously satisfy the specifications by German Federal States for integration into surrounding landscapes of areas rendered again capable of use. By the end of 2010, around 75 % of the revegetation of old mining areas was complete, toward assuring future use by agriculture and forestry. Ecologically especially valuable – and extensively contiguous – areas in the scale of approx. 18,000 hectares make a significant contribution to attractive post-mining landscapes. They can already today be extensive transferred to nature-protection foundations and associations.
- *Coal industries across Europe:* Over the last decade, coal has been the fastest growing source of primary energy, fuelling economic development in many emerging economies, notably in China. It is an important fuel for power generation and underpins competitive electricity prices in many countries. Coal and lignite mining remains a significant industry across the EU, with an output of 531 million tonnes in 2010 meeting 60% of coal demand and employing over 250 000 people. The remaining 40% of demand was met by imported coal from a well functioning international market. Despite the clear economic and energy security benefits that coal brings, EU energy and environmental policies pose many challenges for the future of coal. Ambitious CO₂ emission reduction targets mean that coal must be used more efficiently and new technologies deployed that capture and store CO₂ safely underground. With its efficient coal and lignite mines, supplying the competitively priced fuels that consumers demand, the European coal industry is well placed to face these challenges.

Underground mining

- *Advances in underground longwall mines:* The technological progress since the mid of the 20th century has led to one of today's most productive, safe and cost-efficient mining methods. In hard coal mining, longwalls deliver about 50 % of the World coal production. The success of Longwall Mining can mainly be attributed to the advantage of continuous extraction, to the highly sophisticated equipment and to the high level of automation. Longwall Mining belongs to the most efficient and safe underground mining methods. It has reached a technological level of full automation and nearly man-less operation. First applications of Longwall Mining are probably going back to the 13th century in the Mansfeld Copper Shale in Germany. First historical references to underground coal mining can be found in the 17th century. Thus Longwall Mining has a long history as a mining method in

Central Europe, especially in Germany and the UK (EIA, 1995). From here it spread to most of the other coal mining regions in the world, particularly to Australia, China and to the U.S. It has furthermore found its way to other soft rock deposits such as potash or trona in various regions. Other applications of the Longwall Mining method can be found in underground mining of Platinum-Group-Metals (PGM) or gold in South Africa. Today's modern Longwall Mining on coal is highly mechanized using shearers or plows for extraction, shields for roof support.

Based on analyses, findings and trends derived the following conclusions may serve to outline future developments of Longwall Mining:

- Due to ever increasing shearer speed sooner or later the “walking operator” will have to disappear.
- Because of the more advantageous extraction rate a trend from Room and Pillar Mining towards Longwall Mining at increasing depth can be anticipated.
- The fully automated and thus man-less longwall is at least close to realization and yet has to be brought to maturity.
- The next step is to operate a mine as totally integrated production system in which the fully automated longwall is embedded in the whole process chain, including logistics, development, mine ventilation, etc.
- In high productive operations unplanned downtime caused by unanticipated geological conditions is economically not acceptable. More precise and reliable knowledge of the geological situation in front of the face is therefore indispensable in future.
- As can be deduced from the progress in Longwall Mining productivity in the past decades the “15 Mill. t/a Longwall” in the year 2020 is ambitious nevertheless realistic assumption.

Table 1: Global Hard Coal Production 2009

Hard Coal Production 2009 ¹						
Country	Total coal production ²	Underground coal production		Longwall coal production		
	[Mill.t]	[Mill.t]	% of total	[Mill.t]	% of total	% of UG
PR China	2,971	2,555	86 ³	2,375	80 ⁴	93
USA	975	301 ⁵	31	151	15 ⁶	50
India	526	105	20 ⁷	21	4 ⁸	20
Australia	438	103 ⁹	24	88 ¹⁰	20	86
Indonesia	263	0 ¹¹	0	0	0	0
South Africa	247	116	47 ¹²	7	3 ¹³	6
Russia	229	115	50 ¹⁴	100 ¹⁵	44	87
Kazakhstan	96	32 ¹⁶	33	32 ¹⁷	33	100
Poland	78	78 ¹⁸	100	78 ¹⁹	100	100
Colombia	73	0 ²⁰	0	0	0	0
Total top 10	5,896	3,405	58	2,853	48	84
Total	5,990					

- *Safety and productivity in underground mining industry – KOMAG Poland*: Analysis of lifecycle of mining machines and equipment considering lifecycle of mine workings is examined. Method of virtual prototyping according to technical criteria (functionality, strength, stiffness) and anthropotechnical criteria (ergonomics, work safety and health protection) is given at the stage of machine design. Virtual Working Environment, which consists of computer models of machines and models of human anthropotechnical features, is described for the machines operation stage. Relationships between people and machines are analyzed in this environment. Technical and health hazards are identified. Results of tests carried out for longwall systems and underground transportation at the KOMAG Institute of Mining Technology (Laboratory for Modelling Methods and Ergonomics) are discussed. Studies on shaping the safety of designed mining transportation systems (railways and suspended monorails) and on maintenance of longwall shearers were conducted within the projects financed by the Research Fund for Coal Steel (IAMTECH, MINTOS). The following methods aiding the process of shaping safe work conditions are given: Geometrical Modelling, Finite Elements Methods, Rigid Body Modelling and Analysis, Human Body Modelling, Computer Fluid Dynamics, Biomechanical Analysis. These methods belong to designing and operational knowledge resources, which are organized in a form of knowledge repositories using Knowledge Engineering tools (knowledge acquisition, storing, arrangement and dissemination). Methods and tools for safety shaping are dedicated to the different groups of mining machines and equipment users; engineering personnel and miners employed at the workplaces underground.

Potential collaborators

- Department of Mining Engineering, McGill University, Canada: Thermal and humidity control in underground mines.
- Komag Institute of Mining Technology, Poland: development of cost-effective ventilation and total air-conditioning technologies for underground mines.
- Department of Earth Resources Engineering, Kyushu University, Japan: experimental validation of flow and turbulence behaviour in underground tunnel.
- Central Institute of Mining & Fuel Research, India: experimental validation of fire propagation in underground mines

Photos taken during 22nd World Mining Congress & Expo 2011



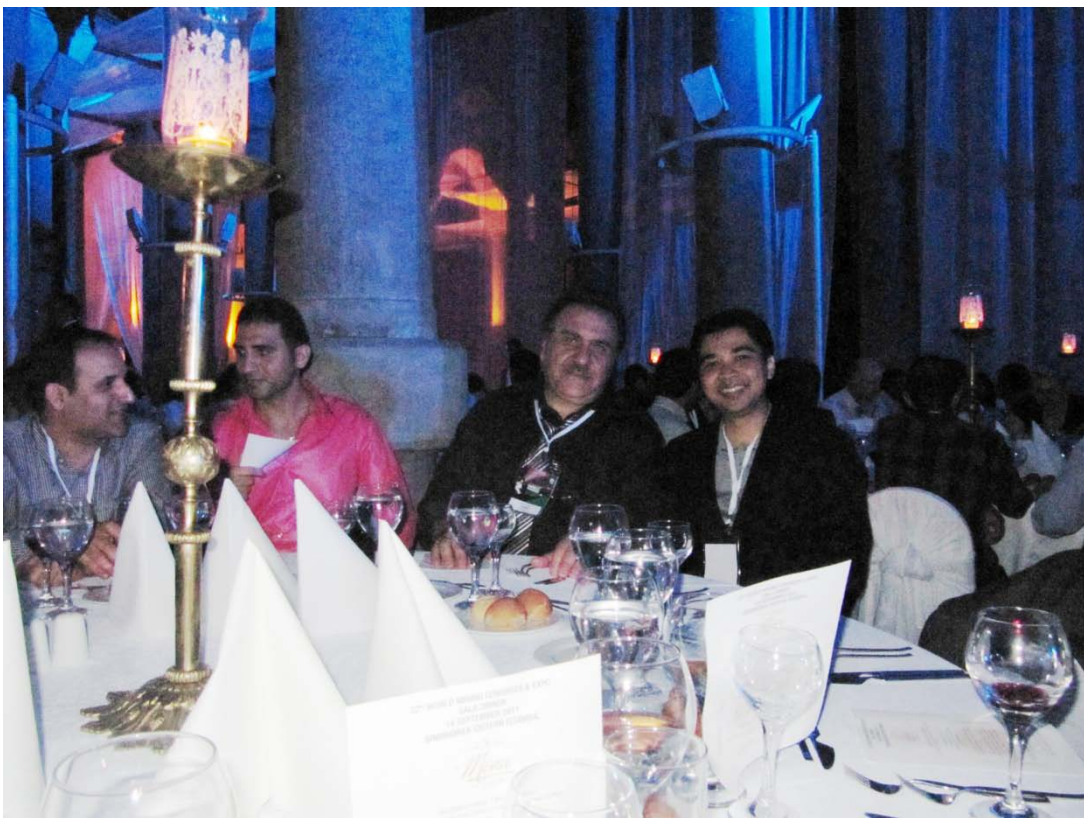
Dr. Agus P. Sasmito presents a paper entitled "Improved ventilation system in underground coal mines - A computational study"



Dr Agus P. Sasmito is answering questions from Prof Kyuro Sasaki of Kyushu University, Japan



Dr Agus P Sasmito receives certificate of appreciation from conference chair



Dr Agus P. Sasmito with Prof Ferri P. Hassani of McGill University, Canada