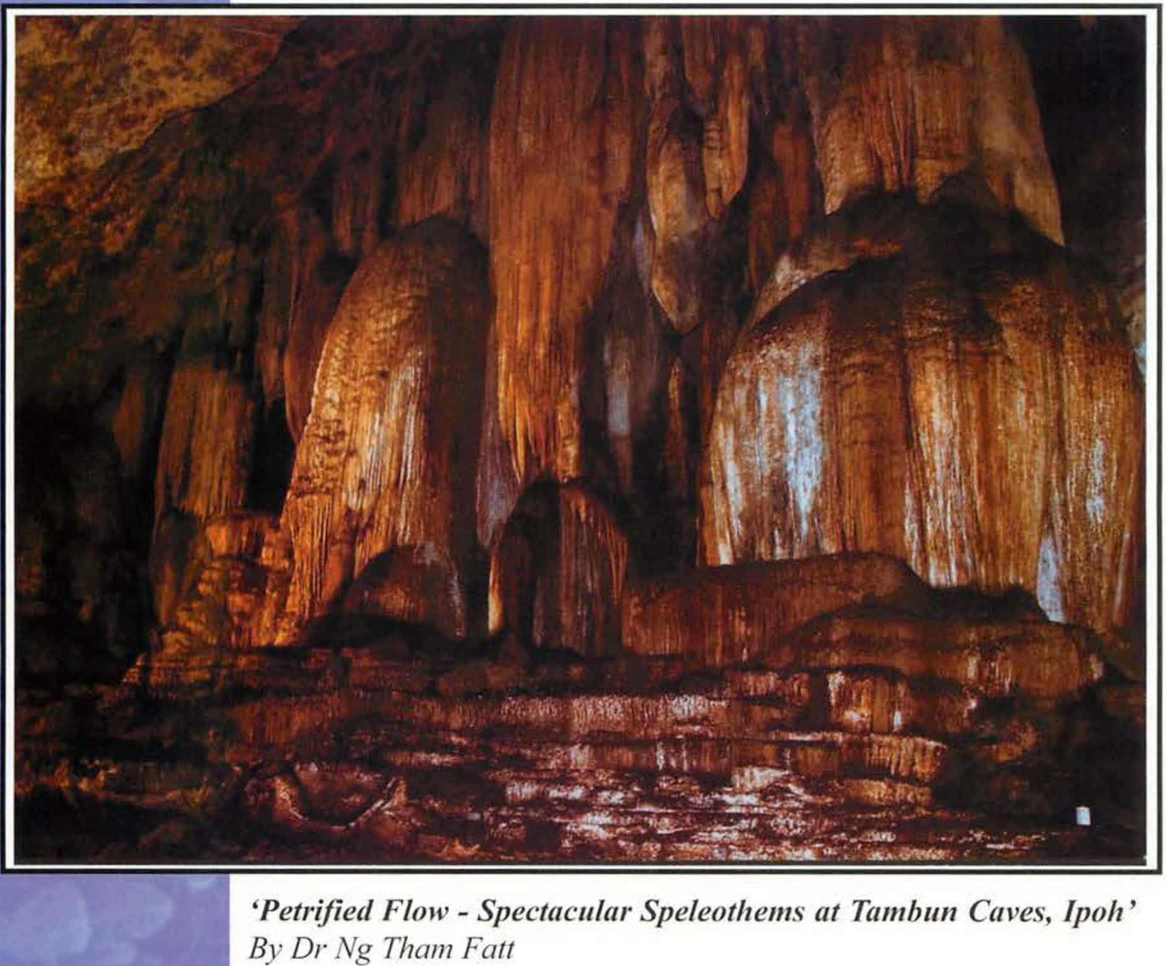
ISSN 0126-5539
PP2509/2/2007

WARTA GEOLOGI

PERSATUAN GEOLOGI MALAYSIA

Newsletter
of the

Geological Society of Malaysia



'Petrified Flow - Spectacular Speleothems at Tambun Caves, Ipoh'
By Dr Ng Tham Fatt
Awarded the Second Prize in the 2005 GSM Photo Competition

Jilid /Volume 32 No 3 May - June 2006

Printed by:
Art Printing Works Sdn Bhd
29, Jalan Riong
59100 Kuala Lumpur
Malaysia

The Society was founded in 1967 with the aim of promoting the advancement of earth sciences particularly in Malaysia and the South-East Asian region.
The Society has a membership of about 600 earth scientists interested in Malaysia and other South-East Asian regions. The membership is worldwide in distribution.

The Warta Geologi (Newsletter of the Geological Society of Malaysia) is published bimonthly by the Geological Society of Malaysia. The Warta Geologi is available free to members of the Geological Society of Malaysia

Geological Society of Malaysia,
Department of Geology,
University of Malaya,
50603 Kuala Lumpur, Malaysia
Tel : 603-7957 7036
Fax: 603-7956 3900
e-mail : geologi@po.jaring.my
URL : www.gsm.org.my

MESSAGE FROM THE EDITOR

The Geological Society of Malaysia (GSM) and the Department of Geology have come a long way since its inception in 1967 and 1956 in the then University of Malaya in Singapore. Perhaps GSM is one of the oldest club in Malaysia and it is still going strong with a lot of activities and participation from the community of geologists. Our geological talks at the Department of Geology and the exhibitions of geo-sciences and petroleum geology organised by GSM and held throughout the year are very well received by the local and international community.

For the month of May and June we saw two great events organised by GSM and the Department of Geology, University of Malaya. These are the National Geoscience Conference and the Geo Asia 2006. Through these conferences we share knowledge, establish new contact, renew old ones and do some networking among the various academicians, professionals and business circle of friends. These two exhibitions have drawn in a lot of local and international professionals to present their abstracts and new findings. Let us congratulate the Organising Committee of both these events for doing an excellent job.

It is thanks to Prof Dr Wan Hasiah, Head of Geology Department at the University of Malaya, who sent me two old photos of GSM and Geology Department and requested that I put the pictures where I deemed fit. And I thought it would be a good idea to publish some 'historical' moment in time of GSM and Department of Geology. With its rich tradition and long standing history it is worthwhile to recapitulate some of its essence by way of printing some old pictures which captured a moment in time the glory, triumph and aspirations of those heady days of being a geology student, of being a geology lecturer or in the participation in the activities of GSM. Though I am not a geologist by training (rather I am a gemologist by profession), on seeing these pictures I too shared their moments of joy.

We need more pictures reminiscent of those good old days of GSM and the Department of Geology in University of Malaya. Most members or students of those by-gone days have now become successful academicians, prominent business man/woman, high level servants, scientists, researchers and head or senior corporate officers of multinational corporations. So go over your old album, scan the pix with high resolution and email it to me at **jadeitejade@gmail.com**.

We would also like more geological notes and geological talks so that the Warta Geologi would be more prominent, more readable and more enjoyable. If there are any suggestions to make it better we are all ears to hear from you.

Best of wishes to all.

Editor
Lau Yin Leong

CATATAN GEOLOGI (Geological Notes)

Minerals Security in Construction – Issues and Challenges for Sustainable Development

Joy Jacqueline Pereira [1], Zuhairi Abd Hamid [2] & Suhaili Ismail[3]

1 Senior Research Fellow, Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia

2 Executive Director, Construction Research Institute of Malaysia (CREAM), Construction Industry Development Board of Malaysia (CIDB)

3 Principal Assistant Director for Industrial Relations, Minerals and Geoscience Department of Malaysia

ABSTRACT:- Minerals security in its broad definition relates to the supply of minerals with respect to its availability and production, which are influenced by economic, social and environmental elements as well as political stability. A comprehensive master plan is required to ensure the security of supply for construction minerals in the context of the construction industry's agenda on Industrialised Building Systems and sustainable development. This is particularly pertinent in view of the current shortage in supply of sand and sterilisation of rock aggregate resources in Selangor. The Minerals Security Initiative has been initiated to address this matter.

INTRODUCTION

Minerals security traditionally relates to the supply of minerals with respect to its availability and production, which are intricately associated with economic elements and political stability. Much work has been done on the security of mineral supplies covering aspects such as the development of mineral security indices, security of access to markets, analyses of lifetime of reserves, impacts of strategic stockpile disposal programmes and total material flows, among others (Ray 1984; Anderson 1988; Wilburn and Goonan 1998; Harker and Lutz 1990; Calaway and van Rensburg 2002; Pereira 2000).

During the Cold War, minerals security was of great concern to developed countries and strategic minerals were stockpiled to mitigate the threat of disruption to imported supplies. Government intervention in the minerals sector gradually ceased with the ending of the Cold War in the 1990s. The onset of market globalisation saw countries such as the United States, United Kingdom and Japan embark on policies to reduce their stockpiles (Humphreys 1995). Minerals production is now considered a private sector activity and the market largely dictates matters related to minerals supply. Thus, the issue of minerals security is assumed to be of lesser importance.

However, this assumption has been questioned by some quarters particularly as the service sector of post-industrial economies still require construction minerals for their infrastructure. This is especially true for construction minerals of bulk commodity, where importing is not an option because of transport costs (Humphreys 1995). Furthermore, the increasing importance given to sustainable development in international, regional and national agendas requires mineral policies that take into account social and environmental elements, in addition to supply and economic considerations.

In this context, the definition of minerals security needs to be broadened from the narrow perspective of simple supply and economic security, to take into account social and environmental elements that affect security. Thus, minerals security relates to the supply of minerals with respect to its availability and production, which are influenced by economic, social and environmental elements as well as political stability. This is particularly true with respect to the majority of construction minerals, which are intricately associated with economic, social and environmental elements throughout their lifecycle, from extraction, production, and utilisation to final disposal. For example, construction aggregate resources may be sterilised due to urban expansion, resulting in a shortage of such materials. This situation could be further compounded by closure of quarries in urban areas due to health, safety and environmental considerations. Similarly, banning of sand dredging along coastal areas due to environmental considerations could threaten the continuous availability of sand if such areas are the primary resource for sand. Clearly, in such situations, trade-offs have to be made taking into account, economic, social and environmental considerations. Therefore, in ensuring the security of construction minerals, all these considerations have to be factored in.

This paper articulates the need to ensure the security of supply for construction minerals in the context of sustainable development. This entails broadening the traditional definition of minerals security to encompass not only economic, but also social and environmental considerations. The paper commences with a brief review of the construction industry in Malaysia, particularly about its agenda on Industrialised Building Systems (IBS) in relation to minerals security. This is followed by an outline of issues facing Selangor with respect to the current sand supply shortage and the possible future emergence of rock aggregate supply shortage. The final section is about the Minerals Security Initiative, funded by the Construction Research Institute of Malaysia (CREAM) and coordinated by the Institute for Environment and Development (LESTARI) of Universiti Kebangsaan Malaysia, in conjunction with the Minerals and Geoscience Department of Malaysia (JMG), which aim to address these issues.

THE CONSTRUCTION INDUSTRY IN MALAYSIA

The construction industry plays an important role in helping the Malaysian government achieve the status of a developed nation by the year 2020. The industry not only supplies the basic infrastructure that underpins all economic activity in the country, but also provides shelter for the population that would make the Vision a reality. With the projected rise of population, the demand for housing is anticipated to be about 1,790,820 units between 1995 and 2020. This demand is expected to rise beyond 2020 (Chen 2000).

The construction industry is the main consumer of non-renewable resources such as rock materials, minerals and metals (collectively termed construction minerals in this paper). Examples of construction minerals include rock materials (aggregates), sand and cement, which are used to make concrete structures; clay minerals and various lightweight aggregates that are used with concrete to make masonry and tile products; and metals such as iron (Fe), aluminium (Al) and copper (Cu) for steel and brass products as well as for plating purposes.

Given the importance of construction minerals to the development of the country, any shortage in the supply of such minerals give rise to serious concerns, not only among industry players but also the government sector. Shortages inevitably result in increased costs to the industry, which then translates down to the consumer, and these are primarily the government who outsource infrastructure projects and house buyers. It is not surprising that such shortages are viewed as "a crisis", which require (and rightly so) some form of government intervention to immediately alleviate the situation. The construction industry has experienced such crisis in the past. The most recent crisis relates to the shortage of sand in the State of Selangor (Star May 23, 2006). Prior to this, in 2004, the crisis constituted nation-wide shortage of steel, which was estimated to cost the housing industry to lose RM 7.4 million a day in liquidated ascertained damages in the form of compensation of late delivery, had it not been addressed (NST July 24, 2004).

Challenges for Industrialised Building Systems

Industrialised Building Systems (IBS) has been touted as an efficient solution to meet the projected demand for housing in Malaysia. IBS refers to construction work where structural components are manufactured in a factory either on or off-site, to be transported and assembled into the desired building or infrastructure with minimal additional site works. The conventional method currently employed is labour intensive, utilises relatively more construction materials and props, takes a longer time to complete, and generates more waste. Notwithstanding this, it is not known how much waste reduction actually occurs, and how the waste from current conventional methods can be reused and recycled to form a new resource base for IBS, given a scenario where transformation to IBS in the country will take a period of time.

There are many delays associated with the conventional system. Delays are one of the most significant sources of cost overruns. A study of factors contributing to cost control problems for IBS conducted in Malaysia revealed that the highest ranked external factor that influenced cost related to materials i.e. its price, availability and supply (Yoke *et al.* 2003). Among the primary factors that contribute to this include demand and supply imbalance, shortage of resources and poor waste management. Materials are also a major cost element for IBS as it contributes more than 50% of its overall cost. Developing countries are more vulnerable to fluctuations in material costs because they depend on imported material manufactured in other countries (Assaf *et al.* 1995; Yoke *et al.* 2003). Given this scenario, it is imperative that the availability and waste generated from materials based on construction mineral resources be given adequate emphasis. This is to ensure that successful transformation from conventional methods to IBS actually generates less waste that is channelled into landfills, whilst extending the supply chain based on optimum usage of local construction mineral resources.

There is considerable need for improving the material supply situation, particularly to increase locally produced IBS, in line with the Government's efforts to develop dynamic industrial clusters (GoM 2001). New value added activities using local construction minerals as well as enhancement of competence in IBS related areas should be identified by extending the supply chain in the construction sector. By strengthening capabilities to utilise new IBS technology based on locally available minerals, the construction sector will be more resilient and less vulnerable to unexpected fluctuations in materials costs. Thus, it is important to develop an inventory of construction minerals suitable for IBS and estimate its availability for the long term, well beyond 2020, to ensure sustainability of IBS clusters.

In this regard, it is also critical to identify waste generated by both IBS and conventional methods, and conduct assessments on how to channel the waste from conventional methods to IBS systems (during the transition period from conventional methods to IBS). This is to ensure more recycling, and reduction of construction waste being disposed of in landfills and dumpsites. There is a great opportunity now to apply the "design for environment" (DFE) approach with a view to optimise mineral consumption and aim for zero waste in the future. At the moment, Sweden is considered the best in the world for IBS (Thanoon *et al.* 2003). The DFE approach in Sweden commenced with clear classification of all mineral resources, to ensure its correct usage for construction. As a result there is practically no waste generated and the economic efficiency is very high.

ISSUES ON CONSTRUCTION MINERALS SECURITY

There are many issues that can emerge as a result of ad hoc policy making, which is partly due to lack of long-term planning, gaps in information and inadequate emphasis on minerals security. In many cases, the issues remain unresolved and keep recurring periodically. Two issues are highlighted below to illustrate the need for long-term planning to ensure minerals security. The first pertains to the current crisis on sand shortage, the second regarding an emerging issue related to rock aggregates.

Shortage of Sand

In 2004, it was reported that problems related to illegal sand mining were increasingly common due to shortage of legal sand sources, resulting in water pollution and damage to ecosystem. The state authorities responded over time with strict enforcement and issuance of a single permit for extraction. Banning of sand dredging along coastal areas was also reported to be prevalent (NST Sept 22, 2004; NST Jun 14, 2004; NST Jun 7, 2004; NST March 3, 2004). Clearly, the continuous supply of sand and accessibility to sand resources was already under threat. However, the issue seemed to be resolved until recently in May 2006, where it loomed to crisis proportions. The price of sand escalated to RM 40 per tonne, from its usual

RM15 - RM18 per tonne, putting to risk implementation of infrastructure projects under the Ninth Malaysia Plan (Star May 23, 2006; Leong 2006).

The current crisis is creating a negative impact on the construction sector and related manufacturing companies. Some analysts believe that the shortage is artificial, as "how could Kuala Lumpur and Selangor run out of sand?" The shortage is attributed to the monopoly of supply and the increasing cost of transportation due to the recent diesel hike. Others are of the opinion that sand is indeed a depleting resource in Selangor because of its sterilisation due to the rapid expansion of built-up areas. The state has responded by invoking inter-state sand transfer and encouraging private landowners to conduct sand mining on their plots. This is to counter the lack of state-owned land that could be used as sand mines. These measures may serve to address the current crisis but may prove to be unsustainable in the long-term as many questions remain unanswered.

Will potential sand mine operators be required to practice strict environmental guidelines and will they be regulated by either the Department of Environment or JMG? What of the cumulative downstream environmental impacts of having many sand mines on private land in the state? Who bears the costs – the mine operators though environmental management plans or the public when cleanup is required? What of post-closure rehabilitation? What about alternative sources of sand? In many countries, the supply of sand is derived from both primary sources and secondary recycled materials. In the Netherlands, sand recycling commenced in the early 1990's in respond to the growing volume of waste and scarcity of landfills to received the waste. A strategic master plan was developed to initiate a network for sand recycling and create new value-added industrial clusters (Barros *et al.* 1998).

Such effort requires investment into research and development (R&D), to ensure that the recycled product meets industry specifications. To a great extent, such R&D activities are funded by the private sector, given the fact that the market dictates mineral security matters. Is the market in Malaysia mature enough to take on this responsibility? R&D on recycled construction material is already ongoing in some local universities. Perhaps, what is needed is synergy between regulators of the construction industry, mineral research institutions, universities and the private sector to enhance ongoing research work and create the appropriate climate for introducing nation-wide use of substitute material for sand, from secondary recycled sources.

Sterilisation of Aggregate Resources

The Malay Peninsula is perceived to be rich in aggregate resources because of the tracts of granitic rocks that form the Main Range, the central backbone of the country. A great proportion of the Main Range comprises protected forest reserves, rendering the resources inaccessible for exploitation. At the state level, Selangor is also perceived to be rich in potential for aggregate resources, having access to the southwestern section of the Main Range. However, the reality is that only 6% of the total land area in the state has been identified as high potential areas for aggregate resources (GoS 1999). A large proportion of this high potential area is already inaccessible due to development of built-up areas to support the increasing population and economic activities. Such development activities have also encroached into existing quarry sites, forcing their closure.

At the basinal level, a study was conducted at the Langat Basin, which is the principle source of aggregates consumed in the Klang Valley (Pereira 2004; Pereira and Komoo 2003). The study reveals that that landuse change in the Langat Basin has changed dramatically between 1974 and 1998 (Table 1). The most dramatic change has been in the increase of built-up areas, from 3% to 15% of the total land area, from 1981 to 1998. Unfortunately the expansion of built-up areas has been focused on the high potential area for rock aggregates within the Basin. Only 31% of the high potential area in the Basin is now available for future exploration and exploitation. All the other areas with high potential are either sterilized or unavailable for exploration and exploitation. Should the annual rate of aggregate resource sterilization remain at about 10%, as it was between 1981 and 1998, it is estimated that total sterilization of aggregate resources within the Langat Basin would occur within the next 15 years, unless mitigating measures are taken immediately. The increasing calls for closure of quarries in the Basin due to health, safety and environmental considerations is further compounding the situation on long-term security for supply of rock aggregates.

One security issue that relates to construction minerals in the context of rock aggregates would relate to the need to provide infrastructure to support activity in the Klang Valley and the Multimedia Supercorridor. Another issue relates to the goals of the Selangor State Government to maintain a squatter free state, which necessitates affordable housing for its increasing population. Rock aggregates are bulk commodities where transport costs are a major factor. Generally, transportation of rock aggregates is considered to be not economically feasible beyond a radius of 50 km. The supply of rock aggregates in Selangor is under threat because of land-use practices that makes the resource unavailable, particularly in urban areas. Measures should be taken now to ensure that the construction industry does not become vulnerable to supply shortage problems in the future. This is particularly pertinent in view of the national agenda on IBS, which would require careful rationalisation on the location of aggregate sources, production plants and the intended consumers.

One measure would be to identify and protect areas that serve as important rock aggregate resources as mineral landbanks. Mineral landbanks refers to sites with substantial reserves of specific minerals or rock materials that can be extracted for future use. The landbanks should be maintained for mineral development to sustain future physical development in Selangor. In addition, buffer zones should also be identified around existing quarries. This is to prevent the encroachment of development that would limit the expansion of existing quarries. Quarrying activities in such areas would require stringent environmental guidelines and control, as they would be located in sensitive hilly terrain. The delineation of mineral landbanks is possible under the Selangor State Policy on Environmentally Sensitive Areas (ESAs) that was officially launched on 5 June 1999 (GoS 1999, 2003). The Policy takes into account the importance of an area from the perspective of the implementing government agencies and the perspective of its major function in terms of providing life support systems, heritage value as well as risk associated with hazards. The management of ESAs incorporates the concept of conservation, optimisation of resource use and controlled development. Each agency in the state is now required to identify ESAs that are relevant to their sector, which could then be gazetted or managed based on the degree of sensitivity. In the case of construction minerals, the JMG now needs to identify and prioritise mineral landbanks to be recognised by the state as an ESA. A complete inventory of ESAs at the local level will be very useful for making decisions on applications for land use conversion or applications for planning permission, which are submitted routinely to state and local authorities.

Another measure would be to introduce alternative sources of aggregate to substitute natural sources. This is a common response to reduce the amount of waste generated from the construction industry to improve environmental management. It also reduces the total tonnage of construction waste channelled to landfills as many landfills are closing due to scarcity of land, particularly in urban areas. Recycled construction aggregates are being widely used for low technology applications in many countries. Much research is ongoing in assessing the technical viability of recycled concrete aggregates (RCA) obtained from construction and demolition projects, waste from natural stone industries (quarries) and other sources (Poon and Chan 2006; Tam *et al.* 2005; Almeida *et al.* 2005; Coleman *et al.* 2005; Nagataki *et al.* 2004; Topcu and Guncan 1995). Such work is also ongoing in many local universities. Industry wide application of RCA in Malaysia would require the involvement all players from government, the private sector and academia to synergise and conduct complementary work encompassing R&D for testing technical viability, assessment of economical feasibility, development of appropriate construction industry standards and establishment of an aggregate network, among others.

Table 1: Landuse percentage of the high potential area for aggregates, which represents 35% of the Langat Basin, with an area of 2938 km^2. Source: Pereira and Komoo 2003.

Landuse	1974	1981	1995	1998
Built-up area	3	3	13	15
Forest	53	52	50	50
Water Body	4	4	4	4
Agriculture-based	40	41	33	31
TOTAL	100	100	100	100

THE MINERALS SECURITY INITIATIVE

Why is the construction industry vulnerable to such crisis? What is the next crisis to be anticipated? Can such crisis be anticipated and mitigating measures taken to avert them altogether? In other words, can we reduce the vulnerability of the industry to such crisis? The Construction Industry Development Board of Malaysia (CIDB) has sought to answer these fundamental questions through an ongoing research project funded by CIDB's research arm, the Construction Research Institute of Malaysia (CREAM).

The Project entitled "Materials Security and Waste Management for IBS", commenced in January 2006, coordinated by the Institute for Environment and Development (LESTARI) of Universiti Kebangsaan Malaysia. A major component of the Project is the Minerals Security Initiative, where the Minerals and Geoscience Department of Malaysia (JMG) is the principal partner. The Project has three main objectives. The first is to identify and evaluate waste stream characteristics of IBS as compared to conventional methods. The second objective is to assess the long-term availability of construction minerals for IBS and its relationship to supply and costs i.e. to determine minerals security for the industry. The third objective is to develop "design for environment' (DFE) approaches in the construction industry as a tool to optimise construction mineral consumption and reduce wastage. The geographic focus of the project is the Klang Valley in particular, and Selangor in general. The principal partners for the Minerals Security Initiative of the Project are the JMG and its state office, JMG Selangor. In embarking on the Initiative, effort will be made to collaborate closely with the State Government of Selangor and all stakeholders involved in construction minerals, from its extraction, production and utilisation to final disposal.

The Project will support the Construction Industry Master Plan (CIDB 2005) that emphasises integrating the construction industry and its value chain to enhance efficiency and improve productivity, and striving for environment friendly and sustainable construction processes and resource management. The focus will be on capacity building and policy advocacy through meetings and dialogues with government agencies, at national, state and local levels as well as all relevant stakeholders. A one-stop source for information on construction minerals critical for IBS will be developed, which can be regularly updated. Under the custodianship of CIDB and JMG, this will support efforts to ensure minerals security in the construction industry.

CONCLUDING REMARKS

Minerals security in its broad definition has not been comprehensively studied in the country. Information of the availability of minerals is available at the JMG, which also regulates the extractive industries in part. The issuance of permission to extract minerals remains with the state. However, work is pending on prioritising construction mineral resources to meet the demands of development, and identifying these as mineral land banks for supporting development in and around urban areas. A comprehensive master plan incorporating economic, social and environmental issues, which takes into account the needs of the producer (the extractive industry), consumer (construction industry and its customers) and custodian (state governments) of construction minerals is required for long-tem management of construction minerals. This is because the issues involved are complex and multi-dimensional, requiring multi-stakeholder consultation and negotiation. In this context, the Minerals Security Initiative seeks to reduce the vulnerability of the construction industry with respect to construction minerals, to ensure that the IBS agenda in Malaysia is not compromised.

References

Almeida, N., Branco, F. and Santos, J. R. 2005. Recycling of stone slurry in industrial activities: Application to concrete mixtures. *Building and Environment*

Anderson, D.L. 1988. Implications of the Canada-USA free trade agreement for the Canadian minerals industry. *Resource Policy*. Vol. 14. No. 2, 121-134.

Assaf, S.A., Al-Khalil M. and Al-Hazmi, M. 1995. Causes of Delay in Large Building Construction Projects. *Journal of Management in Engineering*, 11 (2), 45-50.

Barros, A.I., Dekker, R. and Scholten, V. 1998. A two-level network for recycling sand: A case Study. *European Journal of Operational Research*, 110 (1998), 199-214.

Calaway, L. and van Rensburg, W.C.J. 2002. US strategic minerals: Policy options. Resources Policy. Vol. 8. No. 2, 97-108.

Chen, E.L.L. 2000. An Overview of the Malaysian Property Market. Paper presented at the UPM Workshop on "Environment Friendly Township for Developing Countries", Serdang, Malaysia.

Coleman, N.J., Lee, E.W. and Slipper, I.J. 2005. Interaction of aqueous Cu^{2+}, Zn^{2+} and Pb^{2+} ions with crushed concrete fines. *Journal of Hazardous Materials.* B121 (2005), 203-213.

CIDB 2005. Final Release of Construction Industry Master Plan for Malaysia (2006-2015), Construction Industry Development Board of Malaysia (CIDB), Kuala Lumpur.

Government of Malaysia (GoM) 2001. *The Third Outline Perspective Plan 2001-2010.* Economic Planning Unit, Kuala Lumpur.

Government of Selangor (GoS) 1999. *Strategi Pembangunan Mampan dan Agenda 21 Selangor: Kawasan Sensitif Alam Sekitar*, Institut Alam Sekitar dan Pembangunan (LESTARI), Bangi.

Government of Selangor (GoS) 2003. Agenda 21 Selangor-Selangor's Commitment to Sustainable Development. Town and Country Planning Department of Selangor, Shah Alam.

Harker, R.I and Lutz, T.M. 1990. Securities of mineral supplies. *Resources Policy.* Vol. 16. No. 2, 115-127.

Humphreys, D. 1995. Whatever happened to security of supply? Minerals policy in the post-Cold War world. *Resources Policy.* Vol. 21. No. 2, 91-97.

Leong, N. 2006. A sandy situation. Biz Week, The Star, May 27: 8.

Nagataki, S., Gokce, A., Saeki, T. and Hisada, M. 2004. Assessment of recycling process induced damage sensitivity of recycled concrete aggregates. *Cement and Concrete Research*, 34 (2004), 965-971.

Pereira J.J. 2004. Ecosystem Health Indicators for Mineral Resource Management. *In*: A. Latiff, J.J. Pereira, A. Hezri Adnan and A.A. Aldrie (Editors) *Indicators of Sustainable Development: Assessing Changes in Environmental Conditions*, LESTARI Publishers, Kuala Lumpur. 183-198.

Pereira, J.J. 2000. Mineral Resource Flows in the Langat Basin. In: Mohd Nordin Hj. Hasan (Ed.) *Kesihatan Ekosistem Lembangan Langat - Prosiding Simposium Penyelidikan Lembangan Langat* [Langat Basin Ecosystem Health – Proceedings of the Research Symposium on Langat Basin]. Institute for Environment and Development (LESTARI), Bangi, 115-125.

Pereira, J.J. and Ibrahim Komoo, 2003, Addressing Gaps in Ecosystem Health Assessment: The Case of Mineral Resources. *In*: D.J. Rapport, W.L. Lasley, D.E. Rolston, N.O. Nielsen, C.O. Qualset, and A.B. Damania (eds.) Managing for Healthy Ecosystems, Lewis Publishers, Boca Raton, Florida, 905-916. **

Poon, C.H. and Chan, D. 2006. Paving blocks made with recycled concrete aggregate and crushed clay brick. *Construction and Building Materials*, 20 (2006), 569-577.

Ray, G.F. 1984. Mineral reserves: Projected lifetimes and security of supply. *Resources Policy.* Vol. 10, No. 2, 75-80.

Tam, V.W.T., Gao, X.F. and Tam, C.M. 2005. Carbonation around near aggregate regions of old hardened concrete cement paste. *Cement and Concrete Research*, 35 (2005), 1180-1186.

Thanoon, W.A.M., Lee, W.P., Mohd Razali A.K., Mohd Saleh Jaafar and Mohd S.S. 2003. The Experiences of Malaysia and Other Countries in IBS. *In*: Mohd Saleh Jaafar *et al.* (Editors) *Proceedings of the International Conference on IBS*, CIDB, Kuala Lumpur. 255-262.

Topcu, I.B. and Guncan, N.F 1995. Using waste concrete as aggregate. Cement Concrete Research, Vol. 25. No. 7, 1385-1390.

Wilburn, D.R. and Goonan, T.G. 1998. Aggregates from natural and recycled sources – economic assessments for construction applications. *U.S. Geological Survey Circular 1176.* U.S. Department of the Interior and U.S. Geological Survey.

Yoke, L.L., Hassim S. and Kadir M.R.A. 2003. Factors Contributing to Cost Control Problems in Malaysian IBS Construction. *In*: Mohd Saleh Jaafar *et al.* (Editors) *Proceedings of the International Conference on IBS,* CIDB, Kuala Lumpur. 237-253.

★★★★★

Manuscripts received on June 19, 2006

PERTEMUAN PERSATUAN (Meeting of the Society)

Ceramah Teknik (Technical Talk)

THE ASIAN TSUNAMI OF 2004: OBSERVATIONS & NUMERICAL SIMULATION

25 May 2006
Geology Department
University of Malaya

(in collaboration with the Dept of Geology, University of Malaya)

Dr. KENJI SATAKE
National Institute of Advanced Industrial Science and Technology (AIST)
Tsukuba, Ibaraki, Japan
email : kenji.satake@aist.go.jp

Report

Dr. Satake was in Malaysia, attending a Fluid Dynamics conference in Kuala Lumpur, so we arranged for him to give a talk at the Department. The talk was very well attended, including a number of visitors from the Malaysian Department of Meteorology, who are charged with designing and implementing the Malaysian Tsunami Early Warning System.

Dr Nur Iskandar Taib

Summary

The seabed off Japan is highly active, seismically, and the Japanese coastline is at risk from frequent locally-generated tsunami. While it is comparatively easy, with the technology available to us today, to detect and warn populations of tsunami generated in distant waters across ocean basins, it is much more difficult to issue effective, accurate warnings for tsunami generated in nearby waters, since the time between earthquake and landfall may only be a few minutes. The Japanese Meteorological Agency runs the most advanced tsunami early warning system in the world, capable of issuing accurate warnings to coastal residents within minutes of the occurrence of a local, tsunamigenic earthquake. Part of their arsenal is a huge database, filled with data generated partly using numerical models, which allows them to quickly look up the characteristics of tsunami generated by earthquakes in a given location and of a given magnitude.

The main topic of Dr. Satake's talk was the modeling of tsunami using numerical methods, but he also talked about the JMA tsunami warning system, its successes (and failures – mainly because the tsunami hit minutes before warnings could have been issued), civil defense considerations; and some earlier work he did in tracing the earthquake (which occurred in the Northwest of North America) that generated a sunami which inundated the eastern coastline of Japan in the year 1700. This work was published by the USGS and the University of Washington Press in the book "The Orphan Tsunami of 1700", a copy of which Dr. Satake presented to the GSM.

Ceramah Teknik (Technical Talk)

KL EXPLORATIONISTS
MONTHLY TECHNICAL TALKS & SOCIAL GATHERINGS
KL CONVENTION CENTER

Report

One of the best kept secrets, it seems, has been a series of geological talks organized by the KL Explorationists, an offshoot of SEAPEX, and sponsored by several companies in the E&P industry who are based in KL. As organizer Trent Rehill put it, every oil town has meetings like this, where exploration geologists get together to share knowledge and network. KL might not strike one as being an "oil town", but it is, given the number of E&P and service companies with a presence and the correspondingly large number of personnel based here.

The events take place once a month, usually on a Wednesday and are free of charge. Typically, doors open at 5:30pm with refreshments served and the talks start at 6:30pm. The venue for the last few months was at the KL Convention Center. The talks have all been very well attended to the point where the move to the larger venue was necessary. Unfortunately, only a very small number of GSM members seem to be aware of these most interesting talks, with a correspondingly small number attending. The events are totally informal, one need not stay for the entire evening and there is an area outside where attendees can sit, talk and network while the meeting is in progress. Before the main talk begins a shorter more informal presentation, dubbed "Rock Shots", takes place. This can be anything of geological interest, usually a half dozen photographs or so from some exotic location or of exotic geology. We've had people shown some very unusual reservoir rocks (60% porosity), odd structural features from deepwater offshore, incredible multi-kilometer scale edge-on exposures of a turbidite complex in Namibia (visible on Google Earth) and pictures from the "good old days".

While most of the speakers are from the oil and gas industry, anyone with an interest in geology, especially for those in depositional environments or in global or regional tectonics, would benefit. The talks are not overly technical and are often illustrated with interesting photos or 3D seismic images. The most recent speaker was Bob Dunbar, CEO of Strategy West (Calgary, Canada) who spoke on the unusual tar sands of Canada, which represents a hydrocarbon resource second only in size to that of Saudi Arabia. Some other recent speakers have been Dr. Peter Rose, the president of AAPG; Dr. Henry Posamentier, AAPG distinguished lecturer, who spoke on the morphology of turbidite complexes and our own Dr. Charles Hutchison, who took us on a "Geological stroll across Northwest Borneo."

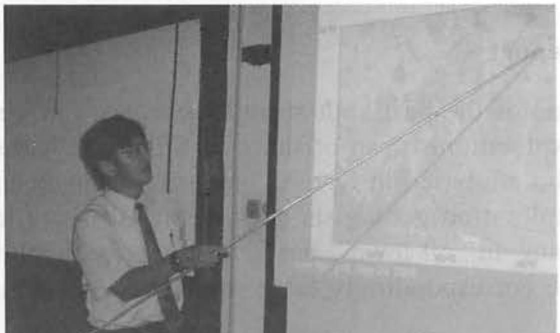
For the past two years or so, the talks have been organized by Trent Rehill, senior exploration geologist with Murphy Oil. Unfortunately, Trent is moving on, having accepted a position exploring for oil in Libya. Chris Howells, Principal Geologist with CS Mutiara Petroleum, will be taking over for the 2006/07 season. The first talk of the new season will take place on September 6th, by AAPG distinguished Lecturer Craig Shipp, the title will be announced later. The organizers would also like to see more involvement by GSM members, not only as attendees, but as presenters. Most of the attendees come from overseas, and while they are mainly interested in oil and gas, they are also geologists who would like to know more about Malaysian geology in general. If you have a half dozen interesting slides it would be a prefect opportunity to present it as "Rock Shots". GSM helps to spread the word by posting notices of these events on its website. Look under "Technical Talks". You can also join the KLEX e-mail list through which notices and reminders of the talks are sent by sending an email to organizer Chris Howells at "christopher_gh@csmpetroleum.com".

(Manuscripts received on 27 June 2006)

Dr Nur Iskandar Taib

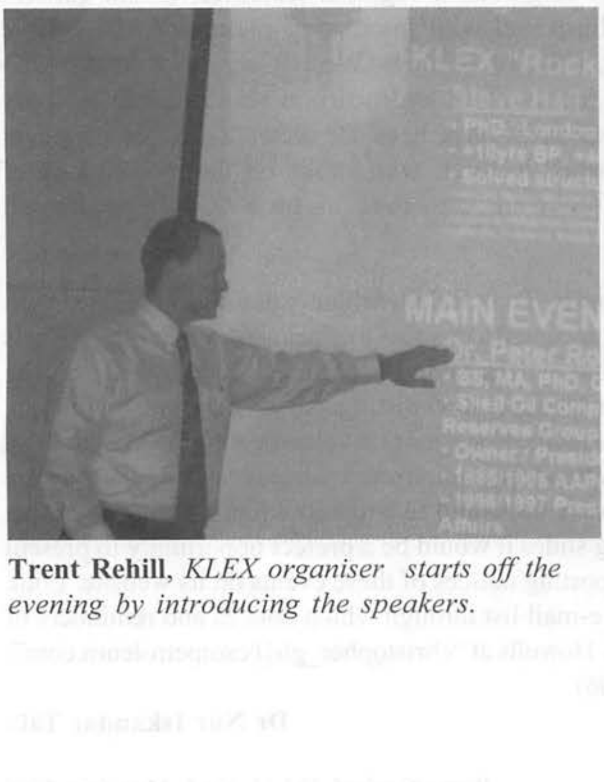
Photos from Technical Talks

THE ASIAN TSUNAMI OF 2004: OBSERVATIONS & NUMERICAL SIMULATION

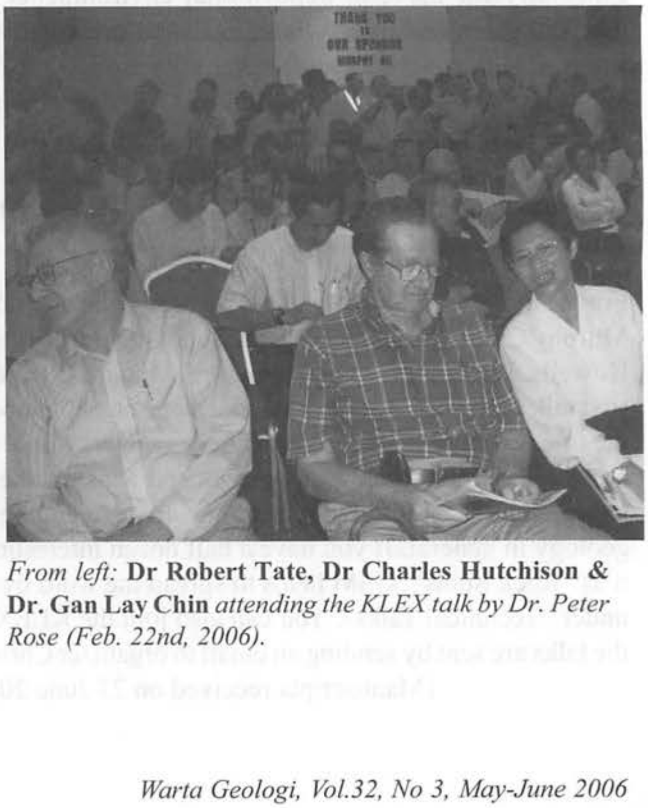


Dr. KENJI SATAKE *National Institute of Advanced Industrial Science and Technology (AIST) Tsukuba, Ibaraki, Japan*

KL EXPLORATIONISTS MONTHLY TECHNICAL TALKS & SOCIAL GATHERINGS KL CONVENTION CENTER



Trent Rehill, *KLEX organiser starts off the evening by introducing the speakers.*



From left: **Dr Robert Tate, Dr Charles Hutchison & Dr. Gan Lay Chin** *attending the KLEX talk by Dr. Peter Rose (Feb. 22nd, 2006).*

Geological Society of Malaysia
and
University of Malaya

National Geoscience Conference 2006

ARMADA HOTEL, PETALING JAYA, SELANGOR
12 - 13 JUNE, 2006

Geology : Development and Conservation

Geological Society of Malaysia,
c/o Department of Geology,
University of Malaya
50603 Kuala Lumpur
(603) 7957 7036 (phone)
(603) 7956 3900 (fax)
geologi@po.jaring.my

Programme with Abstracts

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

Organizing Committee

Samsudin Hj. Taib (Chairman)
Ahmad Tajuddin Haji Ibrahim
Nur Iskandar Mohd Taib
Che Noorliza Lat
Ros Fatihah Muhammad
Tajul Anuar Jamaluddin
Jasmi Hafiz Abdul Aziz
Mohd Azamie Wan Abd Ghani
Nur Huda Mohd Jamin
Anna Lim
Mohd. Noor Aizad Morad
Chong Boon Leong

Editorial Committee

Nur Iskandar Taib (Chief Editor)
Ahmad Tajuddin Hj Ibrahim
Samsudin Hj Taib

Reviewers

John Kuna Raj
Tajul Anuar Jamaluddin
Samsudin Hj. Taib
Askury Abd. Kadir
Mohd. Rozi Umor
Abdul Ghani Rafiq
Chow Weng Sum
Nuraiteng Tee Abdullah
Lee Chai Peng
H.D. TjiaAzman A. Ghani
Ng Tham Fatt
S. Paramananthan
Charles S. Hutchison
Saim Suratman
Ros Fatihah Muhammad
Uyop Said

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

Monday, 12 June 2006

0800 – 0900	Registration
0900 – 0930	Welcoming Address by Organising Chairman of National Geoscience Conference 2006, President of Geological Society of Malaysia, Head, Department of Geology, University of Malaya and Officiating Ceremony by Tuan Hj. Yunus Abdul Razak, Mineral and Geoscience Department.
0930 – 1000	Tea Break

Technical Session I – Engineering Geology and Hydrogeology

1000 – 1030	Keynote Paper: History & Development of Geoscience Education in Malaysian Universities: A UM perspective (Prof. Dr. Wan Hasiah Abdullah)
1030 – 1050	Engineering Geology of Kota Kinabalu, Sabah, Malaysia (Rodeano Roslee, Sanudin Tahir & S. Abd. Kadir S. Omang)
1050 – 1110	Survei potensi air tanah dengan menggunakan kaedah keberintangan geoelektrik di projek cadangan pembangunan Tapak Ramsar, Tasik Bera, Pahang Darul Makmur (Lakam anak Mejus & Rahman Yaccup)
1110 – 1130	Leaching column tests on arsenic-soil interactions (Tan Boon Kong)
1130 – 1150	Delineation of groundwater flow within a coastal wetlands system using hydraulic, geochemical and stable isotope data (Selvarajah Marimuthu)
1150 – 1210	Groundwater investigation in Kuala Selangor using Vertical Electrical Sounding (VES) surveys (Umar Hamzah et al.)
1210 – 1230	Past and present-day coastal changes between Kuala Sungai Besar and Kuala Besar, Kelantan Darul Naim (J.K.Raj et al.)
1230 – 1400	Lunch / Prayer Break

Technical Session II – Sedimentology, Stratigraphy & Paleontology

1400 – 1420	The occurrence, genesis and characteristics of primary kaolinitic clay deposit of Bukit lampas, Km 12 – 13, Spg. Pulai – Pos Slim, Ipoh (Kamar Shah Ariffin, et al.)
1420 – 1440	Some deep water Middle Triassic Forminifera from the Semanggol Formation (Basir Jasin)
1440 – 1500	Exceptional preservation of corals and molluscs by iron oxide replacement in Holocene beach rock in Pulau Sibu, Johor, Peninsular Malaysia (Lee Chai Peng & Nur Iskandar Taib)
1500 – 1520	Neocomian palynomorph assemblage from Central Pahang, Malaysia (Uyop Said et al.)
1520 – 1540	Sedimentological and paleontological studies in the Kubang Pasu Formation from Wang Kelian area, Perlis (Rahida Embi et al.)

Technical Session III – Environmental Geology

1540 – 1600	Geoscience in landuse planning for environmental sustainability (Joy Jacqueline Pereira & Ibrahim Komoo)
1600 – 1620	Six-year record of rate of limestone dissolution in Kinta Valley, Malaysia (Ros Fatihah Muhammad)
1620 – 1640	Tea Break

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

Tuesday, 13 June 2006

Technical Session IV – Structural Geology & Conservation

0900 – 0920	Geoscience in the Quran 3: "Geoscience in the Quran" - as a subject at university level for geoscientists
0920 – 0940	Penilaian geokepelbagaian di Pulau Anak Burau, Langkawi (Tanot Unjah & Ibrahim Komoo)
0940 – 1000	Climate change: Contribution of geosciences and looking at the present trend (Kamaludin Hassan)
1000 – 1030	Tea Break

Technical Session V – Petrology and Geochemistry

1030 – 1050	Diorit Kompleks Igneus Lanchar, Pahang: Perbandingan petrografi dan geokimia dengan diorit Kompleks Igneus Benom (Mohd. Rozi et al.)
1050 – 1110	Batuan Vokanik dari Pulau Tinggi dan Pulau Sibu, Johor (Azman Abd. Ghani)
1110 – 1130	K-rich basalt in the Bukit Mersing area, Third Division, Sarawak (Nur Iskandar Taib)
1130 – 1150	Batuan volkanik Formasi Semantan di sekitar Gunung Benom (Mohd. Rozi Umor et al.)
1150 – 1210	The mineralogy of gold mineralization of Ajmal Mine, Kechau Tui, Pahang Darul Makmur (Wan Fuad Wan Hassan)
1210 – 1230	Gold mineralization and zonation in the state of Kelantan (Goh Swee Heng et al.)
1230 – 1400	Lunch / Prayer Break

Technical Session VI – Geoscientific Tools & Techniques

1400 – 1420	2D Seismic refraction tomography survey on metasediment at a proposed development site in Dengkil, Selangor (Umar Hamzah et al.)
1420 – 1440	Pencirian sifat tanah baki granit di sekitar kawasan Cheras, Kajang dan Kuala Kubu Bharu, Selangor (Dayang Haspariah Sapri & Wan Zuhairi Wan Yaacob)
1440 – 1500	Keberkesanan kaedah keberintangan geoelektrik dalam kajian rerongga dan pencemaran LNAPL bawah permukaan (Tan Chin Lee et al.)
1500 – 1520	Accessibility of air quality over USM campus using remote sensing and GIS technique (Lim Hwee San et al.)
1520 – 1540	The sorption distribution coefficient (Kd) of lead and copper on the selected soil samples from Selangor. (Wan Zuhairi et al.)
1540 – 1620	Closing Ceremony
1620 – 1700	Tea Break

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

Posters

P1. Characteristics and suitability of Sematan-Lundu and Sungai Suai-Kuala Niah silica sand, Sarawak for glass-making industry (Kamar Shah Ariffin et al.)

P2. Discontinuity controlled cut-slope failures on weathered low-grade metamorphic rocks along the East-West Highway, Grik to Jeli (Mustaffa Kamal Shuib et al.)

P3. Paired host-enclave geochemistry of mafic microgranular enclaves (MME) in the Eastern Belt granite, Peninsular Malaysia (Azman Abd. Ghani)

P4. Field evidence of magma mixing in plutonic rock from the Benom Complex, Central Belt of Peninsular Malaysia (Azman Abd. Ghani)

P5. Textural and geochemical study of the older dyke from Perhentian Island, Peninsular Malaysia (Azman Abd. Ghani)

P6. The use of remote sensing and GIS techniques as an aid to retrieve land surface temperature from landsat TM over Alqissim, Saudi Arabia (Lim Hwee San et al.)

P7. Application of block theory for rock slope stability analysis at Highway Semenyih-Sg. Long (SSL), Selangor State in Malaysia (Haswanto & A. Ghani Rafek)

P8 Jurassic-Cretaceous continental deposits from Eastern Chenor, Pahang. (Zainey Konjing et al.)

P9 Discovery of Lower Devonian Dacryoconarid bed from Hill B Guar Jentik, Perlis: its significance and implications (Ong Swang Theng & Basir Jasin)

P10 A sedimentological study on the Tembeling Group in the South of Maran, Pahang. (Marahizal Malihan et al.)

P11 Extraction process of chromium, cobalt, and nickel from ultrabasic soils, Sabah (Osama Twaiq et al.)

Post-Conference Field Trip, Wednesday, 14 June 2006

8:45 pagi	-	Berkumpul di Jabatan Geologi, UM
9:30 pagi	-	Taklimat dan sesi soal jawab mengenai Projek Tebatan Banjir KL
11:00 pagi	-	Lawatan ke tapak SMART (Road Decking)

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

WELCOME ADDRESS BY THE CHAIRMAN ORGANISING COMMITTEE

The National Geoscience Conference 2006 is the yearly conference by the Geological Society of Malaysia which was known as the Annual Geological Conference. We have adopted the name *National Geoscience Conference* in light of the wider use and application of geological data and concepts in other fields, such as engineering and the environmental sciences and its in line with its increasing importance and application in Malaysia as well as the conference theme: "Geology: Development and Conservation". This conference is jointly organised with University of Malaya through its Department of Geology. The University of Malaya has allocated ten thousand Ringgit Malaysia to organise the conference. We thank the University of Malaya for that.

On behalf of the organizing committee we would like to extend our appreciation and thanks to all who participate in this seminar: the participant for making time to attend and thus acquire the latest in geology, the presenters for the making effort and succeed in presenting the result of their study and research, and share their knowledge, the reviewrs, the donors including Malaysia Smelting Corporation Bhd, and the Head of Department of Geology, University of Malaya Prof. Dr Wan Hasiah Abdullah and the President of the Geological Society Malaysia Prof. Dr C.P. Lee for their support and encouragement. It is the organizing committee member's pleasure to thank Tuan Haji Yunus Abdul Razak, Director General, Department of Mineral and Geoscience, Malaysia for officiating the opening of the National Geoscience Conference 2006. On a personal note I would like to thanks the conference organizing committee members for their dedication in making this conference a success especially the organising committee secretary, Dr. Ahmad Tajuddin Hj Ibrahim.

We hope all participants gain from this conference. Besides the new geological information from the presentation, discussions between participants and collaborations between various agencies are hopefully fostered in this conference. It should be a platform for development of geoscience in Malaysia. Lastly, the committee members wish everyone a meaningful and fruitful conference.

Prof. Madya Samsudin bin Hj Taib
Chairman Organising Committee

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

UCAPAN PRESIDEN PERSATUAN GEOLOGI MALAYSIA, PROF. DR. LEE CHAI PENG

Yang Berusaha Saudari Pengerusi Majlis, Yang Berbahagia Tuan Hj. Yunus Abd. Razak, Ketua Pengarah, Jabatan Mineral dan Geosains Malaysia, Yang berusaha Pengerusi Jawatankuasa Penganjur Persidangan, Prof. Madya Dr. Samsudin Hj. Taib. Tuan-tuan dan puan-puan para hadirin yang dihormati sekalian. Selamat pagi dan salam sejahtera. Terlebih dahulu saya ingin bersyukur kepada Tuhan Pencipta Alam Semesta yang begitu indah ini kerana memberi berkatNya kepada kita semua supaya dapat berkumpul di sini untuk dalam majlis perasmian Persidangan Geosains Nasional 2006.

Saya ingin mengucapkan ribuan terima kasih kepada Tuan Hj. Yunus Abdul Razak kerana sudi datang merasmikan persidangan ini. Saya bagi pihak Persatuan Geologi Malaysia mengucapkan Selamat Datang kepada tuan-tuan dan puan-puan yang dihormati sekalian ke persidangan tahunan ini.

Persidangan Geosains Nasional 2006 ini merupakan persidangan tahunan kali Ke-20 yang dianjurkan oleh Persatuan Geologi Malaysia dari permulaan sampai ke sekarang. Persidangan ini sangat unik dan amat bermakna kerana selepas menamatkan siri Persidangan Tahunan Geologi di Negeri Sembilan yang merupakan destinasi terakhir persatuan mengadakan persidangan tahunan dalam menjelajahi semua negeri di Malaysia, kita kembali ke Lembah Kelang untuk memulakan siri baru iaitu Persidangan Geosains Nasional tahun ini. Persidangan Geosains Nasional Pertama ini juga terdapat lebih bermakna kepada saya sebab ia dianjurkan bersama dengan Jabatan Geologi UM untuk meraikan Sambutan Tahun 100 UM dan juga 50 Tahun Jabatan Geologi UM. Saya ingin merakamkan ucapan tahniah setinggi-tingginya kepada rakan-rakan saya di Jabatan Geologi UM yang bertunkus lumus untuk menanjurkan persidangan ini dan juga pihak pntabiran UM yang menyumbangakan sumbangan wang RM10,000 kepada persidanagan ini. Bilangan kertas sudah bertambah sedikit berbanding dengan tahun lalu seperti yang diharapkan. Saya yakin lebih banyak kertas akan dibentangkan pada tahun depan di Persidanagan GEOSEA yang akan dianjurkan oleh Malaysia sebagai tuan-rumah buat kali ini.

Saya ingin mengambil kesempatan ini untuk merakamkan penghargaan dan mengucapkan ribuan terima kasih bagi pihak Persatuan Geologi Malaysia kepada semua pihak atas sokongan dan bantuan yang dihulurkan untuk menjayakan persidangan ini, terutamanya kepada:-

Yang Berbahagia , Datuk Rafiah Salim, Naib Canselor Universiti Malaya dan juga Yang Berbahagia, Dato Prof. Dr. Hashim Yacob, bekas Naib Canselor UM atas sumbangan kewangan kepada persidanagan ini. Yang Berusaha Prof. Madya Dr. Samsudin Hj. Taib bersama Setiausaha AJK Penganjur, Dr. Ahmad Tajuddin Hj. Ibrahim dan setiap ahli Jawatankuasa Pengajurnya, Dr. Iskandar Taib, ahli-ahli Jawatankuasa Penyunting dan penilai-penilai kertas yang membantu mengeluarkan Buletin khas No. 52 untuk persidangan dalam masa yang singkat, Penderma-penderma, Pembentang-pembentang kertas dan pengerusi-pengerusi sesi dan semua perserta persidangan ini. Sokongan padu yang diberi oleh anda semua kepada saya sebagai Presiden, Persatuan Geologi Malaysia pada tahun lalu sangat dihargai. Akhir sekali, saya memohon ma'af jika terdapat apa-apa kekurangan semasa berlangsungnya persidangan ini. Sekian. Terima kasih.

Prof. Dr Lee Chai Peng
President, Geological Society of Malaysia

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

UCAPAN ALUAN OLEH KETUA JABATAN GEOLOGI, UNIVERSITI MALAYA DI PERSIDANGAN GEOSAINS NASIONAL 2006

PROFESOR DR. WAN HASIAH ABDULLAH
Head, Department of Geology
University of Malaya,

Yang Berusaha Saudari Pengerusi Majlis, Yang Berbahagia Tuan Hj. Yunus Abd. Razak, Ketua Pengarah, Jabatan Mineral dan Geosains Malaysia, Yang Berusaha Prof. Madya Dr. Samsudin Hj. Taib, Pengerusi JK Penganjur Persidangan, Yang Berusaha Profesor Dr. Lee Chai Peng, Presiden, Persatuan Geologi Malaysia, Datuk/ Datin/Tuan/Puan para hadirin yang dihormati sekalian. Assalamualaikum dan selamat sejahtera. Syukur kita kepada Yang Maha Esa kerana dengan rahmatnya dapat kita sama-sama berkumpul dimajlis yang mulia dan bersejarah ini. Selamat datang saya ucapkan pada semua. Kepada Tuan Hj. Yunus Abd. Razak, berbanyak terima kasih diucapkan kerana sudi merasmikan persidangan yang penuh bermakna ini.

Persidangan tahunan Persatuan Geologi Malaysia mulai tahun ini di kenali sebagai "PERSIDANGAN GEOSAINS NASIONAL". Jabatan Geologi, Universiti Malaya pula menyambut 50 tahun kewujudannya, disamping kita turut meraikan 100 tahun penubuhan Universiti Malaya. Semuga kerjasama erat di antara Persatuan Geologi Malaysia dengan Jabatan Geologi Universiti Malaya akan berkekalan selamanya.

Saya ingin mengambil kesempatan ini untuk mengucapkan setinggi penghargaan kepada YBhg. Datuk Rafiah Salim, Naib Canselor Universiti Malaya yang baru serta juga kepada Naib Canselor Universiti Malaya yang terdahulu iaitu Dato' Prof. Dr. Hashim Yaacob di atas sumbangan RM 10,000.00 bagi menjayakan persidangan ini dan sokongan yang sentiasa diberikan dalam memajukan bidang Geosains di Universiti Malaya. Kerjasama yang diberikan oleh ketua jataban/program geologi Universiti Malaysia Sabah, Universiti Sains Malaysia & Universiti Kebangsaan Malaysia juga amat saya hargai.

Sebagai penganjur bersama, saya bagi pihak seluruh warga Jabatan Geologi, Universiti Malaya, ingin merakamkan ucapan ribuan terima kasih kepada setiap ahli dalam jawatankuasa penganjur Persatuan Geologi Malaysia dan Jabatan Geologi yang diterajui oleh Pengerusinya Yang Berusaha Prof. Madya Dr. Samsudin Hj. Taib dan setiausahanya Yang Berusaha Dr. Ahmad Tajudin Hj. Ibrahim. Kepada para pembentang kertas kerja, para penilai, pengerusi sesi persidangan dan semua peserta persidangan, saya ucapkan selamat bersidang dengan jayanya!

Sebagai penutup kata, izinkan saya merakamkan ucapan berbanyak terimakasih di atas sokongan & kerjasama yang telah diberikan kepada saya selama saya menjalankan tugas sebagai Ketua Jabatan Geologi, Universiti Malaya. Sekiranya ada salah & silap atau apa jua kekurangan berbanyak maaf saya pohon. Semuga Jabatan Geologi, Universiti Malaya akan terus maju jaya di bawah kepimpinan seterusnya. Sekian. Terima kasih.

Prof. Dr Wan Hasiah Abdullah
Head, Department of Geology

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

KEYNOTE ADDRESS BY PROF. DR. WAN HASIAH ABDULLAH,

Head, Department of Geology
University of Malaya,

Good Morning Ladies and Gentlemen.

First of all, I would like to say I am very proud to stand before you this morning, in this, UM's Department of Geology 50th anniversary year. I would therefore like to thank the organising committee for inviting me to give this keynote address.

50 years! To you and me, it's a long time. Geologically, as we all know, it is nothing, the snap of a finger, the blink of an eye. Just for fun, therefore, let me take the liberty of summarising some geological events of the past 50 years:

· The Atlantic has become about 1 metre wider
· The peat bogs of Sarawak are about 6 inches thicker
· Sungai Pahang has deposited perhaps a few cm of sediment into the south China Sea
· A thin veneer of pelagic ooze has settled onto deep ocean bottoms
· The Indian Ocean plate has subducted perhaps 50 cm under the Java and Sumatra

Some of these geological processes had minimal impact, whilst some have been devastating, emphasising the need for effective geoscience education at many levels, some previously unexpected. Without doubt, the most significant events to have impacted on the lives of communities in Southeast Asia, and beyond, in recent years, have had a geological origin. The tragedy and enormous human suffering caused by the tsunami in December 2004, and more recently by the earthquake that recently shuck Java and the continuing eruptions of Gunung Merapi have all brought geologists unexpectedly into the main gaze of the public eye. Many of us have been approached by the press, RTM, TV3, to give comment and explain why we could not predict such disasters better.

But I digress.

When invited by the organising committee to present a keynote address at this conference, the first 'National Geoscience Conference', I was proud to accept. The following day, it dawned on me that I had no idea what topic I should cover. My first instinct was to fall back on that which I know best and discuss topics on petroleum or coal petrology. But that would hardly be the stuff of keynote addresses for you all today. After mulling over and discussing it with colleagues, the theme of my talk became obvious. I should address the development in Geoscience education & research, and since the Dept of Geology UM is celebrating its Golden Anniversary this year, it would be good to have a trip down memory lane too.

And so the theme of my talk today is to look back at our 50 years as a Geology Department and to share with you some of the steps which we have taken, I will also touch on the joys and pains of setting up a new post graduate program, and finally I will wrap up with highlighting some of the challenges that we, the geoscience community, will need to address in the future.

As this is the 50th Anniversary of UM's Department of Geology, bear with me a while as I take you down memory lane. Although my memory does not go all the way to the start of the lane, I called upon some of the Dept.'s most famous sons, to help me out. I am most grateful to our Emiratus Professor Charles Hutchison for providing me with these historic images.

The history of our geology department can be conveniently subdivided into two era's. The first of these two era's is the Singapore Era. This began in 1955, when Singapore was still a member of the [Malay States] and the University campus was in Singapore. Prior to 1955, geology was still being taught in the university, although as part of the civil engineering degree program. However, University Senate were successfully convinced of the need for a full fledged geology department and thus we came into existence in 1956. The inaugural chair of geology was occupied by Prof. Pichamuthu (seen here on a field trip in 1960) who beefed up his staff over the coming years. One of the first to join him was a young Charles Hutchison, now our Professor Emeritus.

After a short spell in temporary rooms in the main science building, the geology department moved into its first real home, a colonial-style house on Dalvey Road. However, changes were afoot, and the geology department was not to remain there long. The 1959 Carr-Saunders report recommended that the University of Malaya be split into two campus's one in KL and one in Singapore and by 1960 (the year I was born) the geology department had transferred to KL.

Initially we were temporally housed in Jalan Gurney, sleeping on somebody elses floor, before moving onto the current campus where we shared space in the main Science buildings. We moved into our current home in 1968 and finally had space to spread out. However, as staff size and student intake grew, we became very cramped during the late 90's. Subsequently, we were given approval to build a fine extension onto the existing building. And now, once again, we are cramped & are after more space!

During the five decades our role has changed. In the mid 50's, we were essentially a support for the civil engineers. In the late 60's, however, the importance of tin mining emerged & the Geology course content was enhanced to support the mining industry. Thus the introduction of the Applied BSc in Geology in 1968. However, it was only this year, 2006, that we received formal approval to run the program! ..... please don't as me why... it's a long story & history! In the 70's & the 80's, hard rocks were the focus of the Dept. However, in the 90's the importance of the soft rockers i.e. the sedimentologists started to emerge.

Which brings us to the present. Now while our geology department was evolving, new Universities were being established and new Geology degrees being founded in UKM, USM & UMS with the number of student intake increasing for all these universities in recent years. It is most encouraging to know Univerisiti Sains Malaysia & Universiti Malaysia Sabah are aggressively conducting industrial training for their undergraduates. Throughout the years, the industrial landscape was changing. Aging industries, which had indirectly dictated the contents of our degree programs, were slowly disappearing and new industries were being established in their place. Among these are the Geotechnical & Geophysical related industries and Petroleum E & P. These new industries, such as the oil and gas business, required a whole different geological skill set than the earlier mineral-based industries. I personally had many discussions and meeting with oil company managers who expressed polite dissatisfaction that UM graduates did not possess all the desired skills required of new intake into the oil exploration market. Clearly, we had taken for granted the needs of major employers of geology graduates. The blame did not lie with the universities. Nor did it lie with industry. The situation simply arose because of a lack of communication between the two; each assuming the other understood the needs of the other. The Geological Society of Malaysia, I believe, has played a major role in bringing academics and industry to the same table, providing vehicles for discussion and collaboration. And it continues to do so.

The danger, of course, of trying to tailor an undergraduate geology program to meet the requirment of a single sector, albeit a large employer, {example of main employer shown in the slides here}. is that a well balanced degree course could be jeopardised. This could impact on the employability of graduates in other geological sectors. Therefore, in the late 90's, we in the Dept of Geology decided to introduce 4 new post graduate programs, conducted by taught course. However, only 1 programme, the MSc in Petroleum Geology, got the approval of the UM Senate. That being in 1997. It took 3 formats & 2 resubmissions to the Ministry of Higher Education, & only in March of 2005 did we get approval from the Ministry to run the course. So it was not an overnight decision. We had to get management support from UM top brass and buy in from members of the department. Some sacrifices had to be made by the department along the way, especially in terms of space and logistics, and I appreciate and am thankful to the geology department for accommodating the changes. For those of you who have gone through the process of designing a new course and making a reality of it, you are well aware of the work it entails. UKM also has done it and are presently running their MSc in Engineering Geology by taught course. As for the Petroleum related course, we at UM quickly realised that we couldn't do it alone and that we had to go out and find partners, by which I mean people and organisations willing to contribute.

On discussions with industry figures, we were encouraged to discover a great amount of empathy for the plight of national universities and a great deal of enthusiasm and willingness to help out. Furthermore, they recognised the need for such an initiative. Myself and other members of staff have donated a great deal of time and effort to visiting oil companies and service companies to assess their needs and explore avenues for industry-university relationships to flourish. This has been, and continues to be, successful. To give a few examples. Murphy Oil Corporation, a major relatively new player in Malaysian oil exploration, has donated four Sun workstations to us. In addition to the workstations, members of their staff donated a considerable amount of time working with us to ensure the systems were set up and properly configured. Roxar, a geological software company, have provided us with licences for their industry- popular reservoir modelling software, a package designed for constructing virtual 3D reservoir models that can capture every structural and depositional detail. These can be used both as a visualisation aid for better placement of injection and production wells, but also for input into reservoir simulators. Schlumberger are in the process of donating their PETREL package, and Landmark, a leading player in interpretation software, will be providing seismic interpretation software.

Now although such software is powerful, without a good data set they can not be used at their full capacity. So for us, one of the most encouraging and exciting developments was when Murphy Oil Corp and PETRONAS jointly agreed to release to us for academic use a large 3D seismic data set and relevant well data. This was a major milestone for us; such data sets are generally regarded as being of a confidential nature and we were indeed most grateful that PETRONAS approved this data release.

Now although the driver for development of such software was the needs of the oil industry, such software packages are true geoscience tools and are excellent platforms on which to teach and study many of our common geoscience disciplines, regardless of the ultimate application. The prograding development of sedimentary packages, major marine highstands, unconformities and so on and so forth can all be recognised in the seismic data and mapped in the interpretation software and then converted into 3D geological models. Such tools are excellent for demonstrating spatially and temporally complex concepts to students, they also make it a whole lot more interesting and exciting than traditional bookwork. Although, initially, all of this work has been geared towards the MSc program, I have no doubt that the benefits will be felt in our undergraduate programs also.

Our Dept of Geology will never turn its back on the traditional study of geology. There is no substitute for getting out in the field, hammer, handlens, and compass in hand, and studying rocks and their relationships up close and personal. We have all done it and will continue to do so. But we should also embrace the new technology that is becoming available. GPS's and powerful PC's are now as essential to the geologist than his hammer and compass. Even if your field of expertise and your interests lie outside oil and gas, I believe that the technology being developed can be of benefit to all.

And that brings me to one of my final points. Such technology can be of benefit to all geoscientists. But, sadly, it is generally outside the budget of most, especially Universities. That is why good industrial ties are essential for universities. They can often provide funds and facilities which we may otherwise struggle to obtain. But this is not a one-way relationship. The companies concerned see this as an investment on their part. Down the road, they hope that they will reap the rewards of their generosity today. They will certainly have access to better trained graduates who are better equipped to provide a real contribution earlier in their careers, rather than having to go through long extensive training programs which only use up company resources. This is how we hope it will work.

All through the process, we have been getting UM management support. This has manifested itself in many ways, but the most important has been the approval of new posts in the department, including the post of Professor of Petroleum Geology. In addition, we currently have a PhD student studying fluvial and shallow marine depositional system of offshore Sarawak working under Prof. Howard Johnson at Imperial College. It is of course crucial to obtain the right person for the job. When the professor's position was approved we had already identified our man. Denis Tan, a former UM graduate, who early in his career worked with the geological survey, spent most of his working life to date with SHELL where he held several senior posts including Malay basin exploration manager in KL and part of the new ventures team in Houston. Although we thought it would be difficult to land someone with such industrial experience, Denis, to his credit postponed his retirement and turned his back on highly paid industry opportunities to join us last year. We are currently hunting down another senior figure. Stay tuned!

For your information, in our first year of the MSc program, we only had 7 students. This year, we have had 22 applications, only 10 of which have been accepted. Our sales team have clearly done a great job!

The Challenges ahead

I think one of the greatest challenges we face in the coming years is the establishment of sustainable, research centres within our respective geoscience departments. My own personal goal now, is to do just that. Now you all know as well as I that funding of research is never easy. Funding of geological research takes us to a whole new level of difficulty. At the moment biotech is hot. I'm happy for the biotechnologists, and I hope they can achieve something meaningful. But let's not be jealous of the guy next door just because he has a Ferrari and we don't. Let's explore ways of bringing geoscience out of the closet. Perhaps it is time for us to sit down and discuss this dilemma. I see from some of your websites that IRPA funding is achievable for geoscience projects, UKM being particularly successful with these. Congratulations to UKM & LESTARI group. Now there is no more IRPA, but there is the Science Fund. However, there is no clearly defined category for geoscience and so hopefully we can find a home in "Sea to Space" Research Cluster!

Funding clearly is an issue. But I think a greater issue, a greater challenge, is the need to capture the hearts and minds of our smart, young undergraduate students to want to remain in academia and pursue MSc and, preferably, PhD studies. For the smart ones, the temptation to get out and earn big bucks is a major pull factor. With such an obvious pull factor, we need to ensure we are not actively pushing them out. We need to take time to interact with the students, recognise at an early stage potential research students, and encourage them to stay on for a few more years. The big bucks will still be waiting. PETRONAS, for example, have a long term plan to employ 300 geoscientists over the next 5 years. Keeping graduates in research will, of course, be all the easier if our research funds could ensure that our research students could have a reasonable standard of living.

As I mentioned earlier, some of the recent tragedies in the region have brought geologists into the public eye. Now is perhaps the time to be discussing and studying the contributions that the geoscience community can make to minimise the impacts of such natural phenomena. The government is keen to see this happen and for universities to collaborate in this. Thus, it is most encouraging to know that the Metrological Department are discussing a joint collaborative MOU with several Universities i.e. UM, UKM & USM on this subject.

As established public Universities we all need to adhere to QA requirements, one key element of which is "learning outcomes". It will indeed be a challenge for us to produce graduates having these portfolio of learning outcomes. So it is no longer just about providing knowledge, as knowledge can be easily acquired by other avenues, not just attending class.

Concluding Remarks

Now I come to my concluding remarks (the moment you all been waiting for!). What the future holds, no one knows. As geologists, we are supposed to be good at interpreting the past. But what about the future? I personally believe that the future lies in the 3E's, that is Energy, Economics, & Environment. These are the fields which we need to be focussing our educational and research efforts towards. We need to be evaluating where and how geoscience fits into each of these and, as universities, carving out niche areas for ourselves within these. With that thought, I will end my talk.

Thank you for your attention.

PROF. DR. WAN HASIAH ABDULLAH,
Head, Department of Geology
University of Malaya,

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

TEKS UCAPAN PERASMIAN OLEH Y. BHG. TUAN HAJI YUNUS ABDUL RAZAK, KETUA PENGARAH, JABATAN MINERAL & GEOSAINS MALAYSIA

Bismillahirrahmanirrahiim; Yang Dihormati Pengerusi Majlis, Yang Berusaha, Prof. Madya Dr. Samsuddin Haji Taib, Pengerusi Pengajur Persidangan dan Ahli-Ahli Jawatankuasanya. Yang Berbahagia,Naib Canselor Universiti Malaya, Yang Berbahagia, Timbalan Naib Canselor Universiti Malaya, Presiden Persatuan Geologi Malaysia, Prof. Dr. Lee Chai Peng. Ketua-Ketua Jabatan, Tuan-Tuan Profesor, Profesor Madya dan Para Pensyarah Para Geosaintis, Tuan-Tuan dan Puan-Puan, Hadhirin-Hadhirat Yang Dihormati sekelian. *Assalamualaikum w.b. dan Salam Sejahtera;* Terlebih dahulu, saya mengucapkan kesyukuran ke hadrat Allah subhanahuwata'ala di atas rahmat dan limpah kurniaNya hingga kita dapat berkumpul di dalam majlis yang mulia ini. Saya juga mengucapkan ribuan terima kasih di atas kesudian pihak jawatankuasa penganjur kerana menjemput saya untuk menyempurnakan majlis perasmian "Persidangan Geosains Nasional 2006".

Saya difahamkan bahawa "Persidangan Geosains Nasional 2006" sebenarnya adalah nama baru kepada "Persidangan Tahunan Geologi Malaysia" yang telah berlangsung sebanyak 19 kali sejak tahun 1986 lagi. Di mana persidangan pertama telah diadakan di UKM, sementara persidangan ke-19 di Port Dickson pada tahun lepas yang telah merangkumi semua negeri. Kali ke-20, persidangan ini diberi nama baru yang lebih kontemporari iaitu "Persidangan Geosains Nasional" atau "National Geoscience Conference".

Persidangan tahunan ini digerakkan terutamanya oleh tenaga akademik Jabatan Geologi UKM atau UM, di samping pegawai JMG, UMS, USM dan sektor swasta. Pada tahun ini, bersempena dengan sambutan ulangtahun ke-50 Jabatan Geologi Universiti Malaya, ahli-ahli akademik Jabatan ini telah menggemblengkan tenaga membentuk Jawatankuasa Penganjur Persidangan Geosains Kebangsaan 2006. Tahniah dan Selamat Menyambut Ulangtahun ke-50 saya ucapkan kepada Jabatan Geologi Universiti Malaya.

Tuan-tuan/Puan-Puan, Di kesempatan ini, izinkan saya membuat beberapa sorotan ringkas tentang senario geosains dan geosaintis negara sejak beberapa dekad yang lalu. Tujuan saya berbuat demikian ialah untuk kita sama-sama mengimbau kembali peranan geosaintis di peringkat nasional dan untuk sama-sama kita memikirkan halatuju bidang geosains di negara kita yang tercinta ini pada masa hadapan.

Seperti mana yang tuan-tuan sedia maklum, "permintaan" negara terhadap profesion geosaintis amat bergantung kepada beberapa faktor. Antara faktor terpenting adalah:

1) Permintaan terhadap sumber bahan bumi, khususnya petroleum dan bijih
2) Perkembangan ekonomi negara
3) Kebimbangan terhadap bencana alam, khususnya geobencana
4) Keprihatinan terhadap penjagaan dan pemuliharaan alam sekitar dan isu pembangunan mampan.

Empat Faktor ini amat penting kita selami secara mendalam demi "kelangsungan" permintaan terhadap bidang geosains dan perlanjutan jangkahayat profesion geosaintis.

Faktor yang pertama – Permintaan terhadap sumber bahan bumi. Kenaikan harga petroleum yang diumumkan oleh kerajaan baru-baru ini memang amat dirasakan kesannya. Walaupun tidak disenangi oleh ramai rakyat jelata, termasuklah kita sendiri, namun ada hikmahnya yang tersendiri khususnya untuk warga geosaintis. Pada waktu-waktu sebeginilah permintaan terhadap tenaga geosaintis oleh syarikat-syarikat petroleum di seluruh dunia meningkat secara mendadak. Tenaga-tenaga geologis pakar cuba digembleng habis-habisan oleh syarikat-syarikat petroleum, untuk eksplorasi sumber-sumber gas dan petroleum baru. Geologis-geologis baru dicari untuk menambahkan keperluan tenaga kerja, hinggakan pelajar-pelajar jurusan geologi yang masih belum mendapat keputusan tahun akhir pengajian pun sudah ditawarkan tempat oleh syarikat-syarikat petroleum seperti PETRONAS, SHELL dan ESSO.

Permintaan yang tinggi terhadap geologis untuk keperluan industri petroleum ini adalah bersikap sementara. Begitu juga terhadap geologis dalam industri perlombongan mineral bijih timah dan sebagainya. Ia seolah-olah mempunyai kitarannya sendiri, iaitu kira-kira setiap 10-15 tahun sekali. Fenomena kebanjiran geologis ke industri petroleum seperti yang berlaku sekarang pernah berlaku sekitar awal hingga pertengahan tahun 1980an dan 1990an. Apabila keperluan sektor ini terhadap geologis telah mantap, maka kebanjiranlah pula geologis dalam dunia pengangguran. Walaupun trend ini bermusim, namun ia memberikan impak positf terhadap profesion geosaintis.

Menyentuh faktor yang kedua – faktor perkembangan ekonomi. Graduan geologi di negara kita agak bernasib baik kerana perkembangan ekonomi negara yang baik di awal hingga pertengahan tahun 1990an, telah menyaksikan tenaga geosaintis diperlukan dalam pembangunan infrastruktur dan industri pembinaan yang begitu pesat. Mereka diberi tanggungjawab dalam penyiasatan tapak (SI), penilaian kesesuaian tapak, pencarian aggregat bahan binaan/kuari, projek empangan, lebuhraya, lapangan terbang, kawasan pertempatan, perindustrian dan sebagainya. Sekali lagi kita melihat, permintaan terhadap tenaga profesion geosaintis seakan bermusim! Apabila projek-projek infrastruktur ini telah siap, maka ramai geosaintis berpengalaman terkapai-kapai mencari pekerjaan baru. Justeru, tidak hairanlah ramai juga geosaintis yang mengendung fail ke sana ke mari, mencuba nasib dalam sektor insurans, jualan langsung (MLM) dan sebagainya.

Faktor ketiga – kebimbangan terhadap geobencana. Dalam ledakan pembangunan infrastruktur yang rancak, tiba-tiba negara dikejutkan dengan beberapa kejadian geobencana yang diluar jangkaan rakyat Malaysia. Ini adalah hukum alam. Semakin banyak manusia mengubah corak muka bumi, bermakna semakin besarlah gangguan yang telah kita timpakan ke atas keseimbangan ekosistem. Justeru tidak hairanlah semakin banyak berlakunya geobencana. Contohnya kejadian Runtuhan Kondominium Highland Tower (1993) yang mengorbankan 48 nyawa; aliran debris di Genting Sempah pada tahun 1995 mengorbankan 21 nyawa, dan di Pos Dipang pada tahun 1996 meragut 44 nyawa. Dan yang terbaru yang menggemparkan negara ialah kejadian tanah runtuh di Kg Pasir Hulu Klang yang mengorbankan 4 nyawa. Itu belum lagi mengambil kira kejadian-kejadian tanah runtuh di sepanjang lebuhraya utama yang dibina sebelum itu. Tidak kurang juga bencana yang diakibatkan oleh kejadian banjir, banjir kilat, banjir lumpur, hakisan tebing sungai dan hakisan pantai, serta pelbagai bentuk geobencana cetusan manusia.

Peritiwa-peristiwa geobencana ini telah menyebabkan kerugian harta benda bernilai ratusan juta ringgit pada setiap tahun, kehilangan nyawa dan kecederaan manusia. Walaupun amat tragis dan tidak disukai oleh kita semua, namum ia membawa hikmah yang tersendiri khususnya kepada warga geosaintis. Umpamanya, bermula dari pada peristiwa-peristiwa ngeri tersebut, baharulah kehadiran dan input geosaintis dirasai kepentingannya. Kini pendapat dan nasihat daripada geosaintis mula diberi perhatian dan diambil kira di peringkat pembuat dan pelaksana dasar, pemaju dan pemilik projek.

Walaupun kini telah wujud beberapa garis panduan dan syarat tertentu yang mewajibkan penglibatan geosaintis dan input geosains dalam pelbagai projek pembangunan. Tetapi adakalanya masih terdapat "loopholes" yang boleh ditembusi oleh pihak-pihak tertentu selagi ianya bergelar garis panduan dan tidak diwartakan sebagai akta. Seperti mana yang mungkin sebahagian besar daripada tuan-tuan dan puan-puan sedia maklum, kelewatan kelulusan Akta Geologi Malaysia yang diperjuangkan sejak sekian lama oleh Institut Geologi Malaysia, antara faktor utamanya berpunca daripada halangan-halangan yang ditimbulkan oleh segelintir golongan profesional yang merasakan diri dan periuk nasi mereka tercabar sekiranya Akta Geologi Malaysia ini diluluskan.

Tuan-tuan/Puan-puan yang dihormati sekelian;

Walaupun negara kita tidak terdedah secara langsung kepada geobencana seperti letusan gunung berapi dan gempabumi, kejadian geobencana seperti yang tersebut di atas tadi tidak boleh dianggap ringan. Kejadian geobencana seperti ini adalah cabaran besar kepada seluruh warga geosaintis tempatan. Jangan diharapkan sangat kepada kepakaran geosaintis luar negara (import) kerana geologi dan terain kita yang beriklim tropika lembab, ternyata amat berbeza daripada situasi yang mereka alami di rantau mereka. Masalah dalaman atau "rumahtangga" kita sendiri tidak seharusnya diserahkan kepada orang luar untuk menanganinya. Ini hanya akan memberi peluang kepada orang luar untuk menangguk di air keruh atas masalah kita. Kita, warga geosaintis tempatanlah yang seharusnya menjadi pakar kepada masalah geobencana di tempat kita sendiri. Sehubungan itu, peningkatan kejadian geobencana seperti tanah runtuh, aliran lumpur dan sebagainya itu, sepatutnya menyedarkan kita bahawa masih banyak lagi perkara yang perlu kita pelajari, selidiki dan fahami tentang geobencana di negara kita, untuk membolehkan kita menanganinya secara berkesan.

Tentunya tuan-tuan/puan-puan masih ingat;

Seluruh dunia dikejutkan dengan Tsunami 26 Disember 2004. Geobencana yang tidak pernah terlintas dibenak fikiran geosaintis di negara ini, apatah lagi oleh masyarakat awam. Bencana tsunami ini telah membuka suatu lembaran baru kepada warga geosaintis tempatan. Semakin ramai geosaintis diburui oleh masyarakat, kerajaan dan media, untuk menjawab pelbagai persoalan untuk menangani impak geobencana seperti ini sekiranya ditakdirkan berulang lagi. Peristiwa ini juga seharusnya digarap oleh warga geosaintis secara proaktif, untuk membuktikan kepada negara bahawa geosaintis juga sangat relevan dalam meredakan ketegangan dan kebimbangan umum terhadap ancaman bencana gempabumi dan tsunami. Dalam hal ini, sukacita saya maklumkan bahawa JMGM telah mendapatkan geran penyelidikan "Seismic and tsunami hazards and risk studies in Malaysia" berjumlah RM 300,000 daripada Kerajaan Malaysia.

Faktor yang ke-empat – Peningkatan keprihatinan manusia terhadap isu pemuliharaan alam sekitar dan pembangunan mampan. Isu kemerosotan alam sekitar kini semakin hangat diperkatakan di mana-mana sahaja. Ini kita boleh lihat daripada paparan media massa. Hampir setiap malam, di dalam Bulletin Utama TV3 misalnya, kita boleh mendengar laporan Karam Singh Walia yang menghayunkan tangan kirinya berulang kali sambil menyelitkan peribahasa-peribahasa Melayu yang orang Melayu sendiri pun kadang-kadang tak pernah dengar (e.g. *"umpama meluruskan ekor anjing yang bersimpul", "ibarat mengorek lubang, jumpa cacing gelang-gelang", "bagai menyukat anak ayam, masuk empat, keluar lima"; "kambing menanduk bukit, tanduk patah, bukit tak runtuh"* dan berbagai-bagai lagi).

Kebanyakan penyelewengan dan keborosan tindak-tanduk manusia yang dilaporkan lazimnya berkisar tentang isu pencemaran ekosistem alam semulajadi bumi (udara, air dan tanah). Atau dengan kata lain melibatkan bahan bumi dan sekitaran fizikal bumi yang ada kaitan langsung dengan aplikasi bidang geosains. Sebagai contoh, ahli hidrogeologi, geofizik, geomorfologi dan geologi sekitaran, tentunya boleh menyumbang dan memberi ulasan yang sewajarnya tentang masalah dan impak pencemaran air permukaan dan air tanah akibat pembuangan sisa berbahaya. Ahli geologi kejuruteraan pula tentunya amat arif tentang bagaimana berlakunya hakisan, tanah runtuh, banjir lumpur dan aliran debris akibat pemotongan bukit dan kaitannya dengan proses-proses geomorfologi. Begitu juga ahli sedimentologi dengan masalah perlodakan sungai dan tasik, hakisan pantai dan sebagainya, serta langkah-langkah menanganinya secara berkesan mengikut acuan pengetahuan geosains dan keserasian proses di permukaan bumi.

Walaupun ada usaha untuk mempromosikan kepentingan pengetahuan/input geosains dalam isu-isu berkaitan penjagaan dan pengurusan alam sekitar, namun tidak ramai geosaintis yang berani tampil kehadapan untuk menjuarai isu berkenaan. Sebaliknya, hanya melibatkan diri dalam kes-kes penyiasatan setelah berlakunya kegagalan atau berlakunya kemusnahan alam sekitar. Kecenderungan ini seolah-olah menjadi tradisi dan "trade-mark" geosaintis di negara ini. Sudah sampai masanya geosaintis perlu tampil kehadapan, menembusi tembok birokrasi dan tradisi, untuk meletakkan kepentingan input geosains keperingkat pembuatan dan perlaksanaan polisi agar *"lebih banyak nasi tidak menjadi bubur"*.

Tuan-Tuan dan Puan-Puan yang dihormati sekelian;

Daripada sorotan ringkas senario aplikasi bidang geosains yang disebutkan di atas tadi, nampaknya penglibatan geosaintis di negara kita ini di dalam pelbagai aspek dan aktiviti kehidupan seakan-akan bersikap "reaktif". Kita lebih bersikap "hanya menunggu" peluang dan musim yang sesuai, bila diri dan profesyen kita akan diperlukan. Kurikulum geosains yang ditawarkan di IPTA-IPTA tempatan masih tidak banyak berubah daripada apa yang diitawarkan sejak beberapa dekad yang lalu. Walaupun terdapat sedikit rombakan, namun rombakan tersebut ternyata belum cukup untuk menyediakan tenaga kepakaran geosaintis yang sentiasa bersedia dalam apa jua keadaan dan ketika. Dan yang lebih merumitkan lagi keadaan ialah apabila kursus geologi di Universiti disingkatkan daripada 4 tahun kepada 3 tahun sahaja. Semakin banyak rungutan daripada pengguna khidmat geosaintis bahawa kualiti graduan geologi semakin menurun.

Sudah sampai masanya kita melalui Persatuan Geologi Malaysia, Institut Geologi Malaysia, JMGM, Jabatan-Jabatan Geologi di IPTA/IPTS memikirkan dan bertindak lebih proaktif, lebih berani dan lebih kreatif untuk mengetengahkan kepentingan dan meningkatkan martabat bidang geosains dalam pelbagai aspek penghidupan. Demi menjaga kelangsungan bidang geosains, kita tidak boleh lagi merasa selesa dengan kepompong geologi tradisi. Sebaliknya kita perlu mengorak lebih jauh kehadapan lagi.

Tuan-Tuan dan Puan-puan yang dihormati sekelian;

Kesemua ini hanya boleh dicapai melalui usaha keras kita semua. Kita perlu berusaha lebih gigih dengan menjalankan penyelidikan yang terancang, berpandangan jauh ke hadapan, tersusun, kreatif dan intensif. Bukan penyelidikan yang sekadar melepas batuk di tangga, atau yang bertujuan sempit untuk meraih keuntungan dan imbuhan peribadi dalam jangkamasa yang singkat.

Bidang dan profesion geosains pelru dikomersialkan ke setiap aspek kehidupan, supaya keperluan geosaintis akan sentiasa dirasakan kepentingannya oleh sesiapa sahaja dan pada setiap ketika. Janganlah hendaknya geosaintis hanya diperlukan dalam musim-musim atau situasi yang tertentu sahaja. Golongan geosaintis tidak seharusnya membiarkan diri mereka diperlakukan sebagai profesional kelas kedua atau kelas ketiga. Umpama *"tebu, habis manis sepah dibuang."*; atau membiarkan *"lembu punya susu, sapi dapat nama"*.

Sehubungan dengan itu, saya menaruh harapan yang tinggi kepada semua warga geosaintis, khususnya para ahli akademik bidang geosains, khususnya Profesor-Profesor geologi di Intitusi-institusi Pengajian tinggi, supaya sentiasa memikirkan plan-plan tindakan jangka pendik dan jangka panjang yang mampu "menghidupkan" atau merelevankan bidang geosains ke dalam pelbagai aspek kehidupan. Kaji sebaik mungkin, graduan geologi yang bagaimana yang mereka inginkan. Buktikan kepada dunia luar bahawa input geosains itu penting dalam perancangan, pengurusan dan pemantauan; hingga memaksa pembuat dasar akur akan keperluan input geosains. Tunjukkan juga bahawa input geosains itu sangat penting dan relevan dalam industri pelancongan, pertanian, kawalan ekosistem, pengurusan risiko bencana, taktik ketenteraan dan keselamatan negara, sejarah dan budaya serta warisan negara, malah menjangkau jauh hingga ke aeroangkasa.

Akhir sekali saya berharap, dengan kita sentiasa mempersiapkan diri, meningkatkan kemahiran dan peka dengan permintaan semasa terhadap kepakaran geosaintis, maka InsyaAllah, warga geosaintis akan tetap di pandang mulia, dihormati dan sentiasa disegani. Kita cuma perlu berusaha dengan lebih keras dan beriltizam, supaya persepsi orang awam, para pembuat dasar dan profesional-profesional bidang lain sentiasa memandang bahawa geosaintis adalah profesional yang sentiasa relevan dengan pelbagai urusan dan tuntutan semasa kehidupan.

Sebelum saya mengakhiri ucapan ini, saya dengan penuh takzim dan dengan lafadz "Bismillah-hirrahman-nirrahim" merasmikan "Persidangan Geosains Nasional 2006. Selamat bersidang. Semoga Persidangan kali ini akan membuahkan hasil yang diharap-harapkan.

Sekian, wabillahitaufik-walhidayah. Assalamualikum Warahmatullahiwabarokatuh.

Y.Bhg. Tuan Haji Yunus Abdul Razak
Ketua Pengarah, Jabatan Mineral & Geosains Malaysia

Photos from NATIONAL GEOSCIENCE CONFERENCE 2006


Anna registering participants


Tuan Haji Yunus flanked by Dr Lee & Dr Wan Hasiah


A friendly chat...


Welcome address by Dr Samsudin - Org. Chairman


Welcome address GSM President - Dr Lee Chai Peng


Keynote address by Prof Dr Wan Hasiah


Tuan Haji Yunus - Officiating the conference


The ever presence of Prof Dr Charles Hutchison


A light conversation among senior officials


Dr Nur Iskandar - council member of GSM


Mohd Rozi - council member of GSM


Arul the MC thanking the participants

Photos from NATIONAL GEOSCIENCE CONFERENCE 2006


Mr Tan Boon Kong delivering his paper


Prof Dr Lee Chai Peng stressing a point


Participants at the conference


Basir Jasin thanking Nur Iskandar


A participant receiving a souvenir from Dr Lee

Dr Samsudin thanking Mr Chong


Dr Samsudin thanking Dr Ahmad Tajuddin


Dr Ahmad Tajuddin presenting a token to Prof Dr Wan Hasiah


Prof Dr Lee giving his closing address


Mr Tan Boon Kong with Dr Gan Lay Chin


Sumptuous meal at the buffet table


Geology department ladies

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

Technical Session I – Engineering Geology and Hydrogeology

ENGINEERING GEOLOGY OF THE KOTA KINABALU AREA, SABAH, MALAYSIA

RODEANO ROSLEE, SANUDIN TAHIR & S. ABD KADIR S. OMANG

Universiti Malaysia Sabah, School of Sciences and Technology,
Locked Bag 2073, 88999 Kota Kinabalu, Sabah, Malaysia
Tel: (6088) 320000, Fax: (6088) 435324

ABSTRACT: The geology of the Kota Kinabalu area provides a favourable setting for engineering geological instability. Kota Kinabalu is underlain by the Late Eocene – Early Miocene Crocker Formation and Quaternary Alluvium. The Crocker Formation is composed of thick sandstone unit, interbedded sandstone – shale unit and shale unit. These rock units are dissected by numerous lineaments with complex structural styles developed during series of regional Tertiary tectonic activities. The tectonic complexities reduced the physical and engineering properties of the rock masses and produced intensive displacements and discontinuities among the strata, resulting in high degree of weathering process and instability. The weathered materials are unstable and may cause subsidence, sliding and falling induced by high pore pressure subjected by both shallow and deep hydrodynamic processes. This paper describes the engineering geological investigation, appreciation of the complex geology, examination of material properties under specific geological laboratory tests, field testing and mapping, verification of the mechanism of failure and the deduced possible causes of slope failures, settlement, land subsidence and foundation instability. Much of the findings could not have been ascertained without sound understanding of the site geological evolution, inherited unfavourable geological relics and the peculiar but hazardous engineering properties in the Kota Kinabalu area. Geological evaluation should be prioritized and take into consideration in the initial step in all infrastructure program. This engineering geological study may play a vital role in engineering geological problems assessment to ensure the public safety.

SURVEI POTENSI AIR TANAH DENGAN MENGGUNAKAN KAEDAH KEBERINTANGAN GEOELEKTRIK DI PROJEK CADANGAN PEMBANGUNAN TAPAK RAMSAR, TASEK BERA, PAHANG DARUL MAKMUR

(GROUNDWATER SURVEY USING GEOELECTRICAL RESISTIVITY METHOD AT A PROPOSED PROJECT RAMSAR DEVELOPMENT SITE, TASEK BERA, PAHANG DARUL MAKMUR)

LAKAM ANAK MEJUS & RAHMAN YACCUP

Institut Penyelidikan Teknologi Nuklear Malaysia (MINT)
Bangi, 43000 Kajang, Selangor

ABSTRAK: Penggunaan kaedah keberintangan geoelektrik bagi pengimejan keadaan subpermukaan dapat menentukan perbezaan sifat bahan-bahan berdasarkan nilai keberintangan. Kaedah ini sangat membantu dalam kajian eksplorasi air tanah dan menggambarkan keadaan geologi subpermukaan. Kajian telah dijalankan di kawasan hutan simpan yang dicadangkan sebagai projek pembangunan tapak RAMSAR. Hasil survei pengimejan keberintangan geoelektrik memberikan hasil yang amat memuaskan. Ia dapat

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

memberikan maklumat yang diperlukan untuk menentukan kedudukan akuifer. Kajian ini telah mengesan beberapa lokasi kawasan berkeberintangan rendah yang kurang dari 150 Ohm-meter dipercayai merupakan zon retakan batuan (*fractured rock*) yang berpotensi sebagai akuifer. Walaupun terdapat beberapa kawasan yang berpotensi namun hanya kawasan yang berdekatan dengan Tapak RAMSAR yang dicadangkan untuk eksplorasi sumber air tanah. Kedalaman lapisan berpotensi berjulat dari 20 –100 meter dari permukaan dan memenuhi hampir separuh daripada panjang profil garisan survei resistiviti yang dibina. Kerja penggerudian harus dijalankan dan ujian pengepaman dilakukan untuk mengetahui potensi sebenar air tanah di kawasan berkenaan.

ABSTRACT: The use of geoelectrical resistivity method to map subsurface conditions enables determination of different properties of subsurface material based on resistivity values. This method really helps in groundwater exploration work and subsurface geological mapping. A study has been carried out in a forest reserve proposed for RAMSAR project site. The output obtained from the geoelectrical resistivity imaging shows impressive and reliable results. It gives information needed for locating potential aquifer. In this study, several locations with low resistivity values of less than 150 Ohm-meter were identified and interpreted as zone of fractured rock with the potential as an aquifer. Although many potential locations are identified but only one location near the RAMSAR site was recommended for further detailed exploration. The depth of fractured zone ranges between 20–100 meter from the surface and covers almost half of area below the lines of traverse. It is suggested that drilling and pumping test be carried out to confirm the potential of groundwater in the area.

LEACHING COLUMN TESTS ON ARSENIC-SOIL INTERACTIONS

TAN BOON KONG

Geology Programme, Faculty of Science & Technology
National University of Malaysia, Bangi
bktan@pkrisc.cc.ukm.my

ABSTRACT: The leaching column test is a very useful and versatile tool that can be used to study the interactions between soils and various contaminants. This paper presents the results of leaching column tests conducted to examine the interactions of arsenic with soils. The migrations of arsenic through compacted soil columns are monitored for both the sorption and desorption phase of the leaching column test arsenic-soil interactions during these phases. The effects of varying amounts of organics in the soil on the sorption and desorption of arsenic are also investigated. While low contents of organics appear not to have too much effect on the sorption/desorption characteristics of the admixed soils, higher organics contents significantly affect these characteristics.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

DELINEATION OF GROUNDWATER FLOW WITHIN A COASTAL WETLANDS SYSTEM USING HYDRAULIC, GEOCHEMICAL AND STABLE ISOTOPE DATA

SELVARAJAH MARIMUTHU

Minerals and Geoscience
Department Malaysia

ABSTRACT: Both geochemical and stable isotope data provide important supplemental information to more traditional hydraulic data and unravel the processes that underpin the large variations in chemical and stable isotopic composition within a coastal wetland system. The system studied was the Lake Warden wetlands, located in Esperance, in south coast of Western Australia. The spatial and temporal variations of chemical and isotopic composition of the individual water bodies within the system were measured for an annual cycle. In broad terms, the groundwater levels appear to follow the topography but the distinct higher chloride and isotopic concentrations observed within the wetlands were not reflected in the low lying coastal plain groundwater. The hydraulic analysis of the region surrounding the wetlands suggest that the wetlands are flow-through bodies, however the chemical and isotope information indicates the lakes almost invariably act as discharge points for the surface water flows and the north south groundwater flow. The northeast-southwest groundwater flow is along an observed paleochannel within the wetlands system and in this case the chemical and isotopic evidence are complimentary with the hydraulic study.

GROUNDWATER INVESTIGATION IN KUALA SELANGOR USING VERTICAL ELECTRICAL SOUNDING (VES) SURVEYS

UMAR HAMZAH, ABDUL RAHIM SAMSUDIN & EDNA PILIS MALIM

School of Environment and Natural Resource Sciences
Faculty of Science and Technology
National University of Malaysia
43600 Bangi, Selangor, Malaysia.
Tel : 603-89292491
Fax : 603-89292490
aiman9@yahoo.com

ABSTRACT: Integrated geoelectrical and geochemical surveys were used to investigate and delineate different types of groundwater in Kuala Selangor alluvial aquifer. Previous hydrogeological borehole investigation shows that this aquifer contains several types of groundwater in relation to its salinity. The high salinity of the groundwater in some areas is believed to be due to either saltwater intrusion from the nearby sea or river infiltration during high tide season. Vertical electrical sounding (VES) method was employed to study and map the subsurface variation of resistivity in the area. For each sounding measurement, a total spread length of 300 m was obtained with vertical depth penetration of about 100 m. Chemical analysis of the groundwater samples taken from both shallow and deep boreholes was carried out for the water quality determination. A total of 45 VES stations were succesfully established along three parallel roads with direction almost perpendicular to the coastal line. The distance between stations varies from 1 to 2 km with a maximum length of about 60 km_surveyed line. Results of the vertical electrical soundings as well as the chemistry of the groundwater samples show that groundwater in **the**

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

study area can be grouped into fresh groundwater (resistivity >48 Ωm) and brackish groundwater (<48Ωm). The subsurface resisitivity sections derived from the VES study suggest that the area is dominated by brackish groundwater zones especially in the area towards the coastal line. This result appears to agree well with the groundwater pumped from boreholes scattered in the area. Water drawn from boreholes near the coast shown higher salinity compared to the water pumped from inland boreholes. Chloride values greater than 250 mg/L are considered to represent the brackish water zone whilst values less than 250 mg/L represents zones of fresh groundwater.

PAST AND PRESENT-DAY COASTAL CHANGES BETWEEN KUALA SUNGAI BESAR AND KUALA BESAR, KELANTAN DARUL NAIM

J. K. RAJ, ISMAIL YUSUFF & WAN HASIAH ABDULLAH

Department of Geology,
University of Malaya,
50603 Kuala Lumpur.

ABSTRACT: The Kelantan Darul Naim coast between Kuala Besar (the present outlet of the main distributary channel of Sungai Kelantan) and Kuala Sungai Besar (an abandoned outlet of Sungai Kelantan and now the mouth of Sungai Pengkalan Datu) trends northwest-southeast over some 14 km and comprises stretches of sandy beach, interrupted by small river mouths at Kuala Pak Amat and Kuala Semut Api. The stretch of beach between Kuala Sungai Besar and Kuala Pak Amat is known as Pantai Sabak, whilst that between Kuala Pak Amat and Kuala Semut Api is known as Pantai Cahaya Bulan and that between Kuala Semut Api and Kuala Besar, Pantai Mek Mas. Aerial photographs flown in 1948, 1949, 1957, 1966 and 1974 show that in the past, there has been an overall recession of the coast between Kuala Sungai Besar and Kuala Besar; this recession due to a northwest directed littoral drift that results from the oblique approach of wave-fronts from the South China Sea throughout the year, especially during the Northeast Monsoon. Breakwaters constructed on both sides of Kuala Sungai Besar between 1986 and 1987 have accentuated the effects of the littoral drift resulting in present-day accretion of sediments up-drift of the southern breakwater, but erosion and shoreline recession down-drift of the northern one. Continued erosion, especially during the Northeast Monsoon, now threatens several fishing villages and recreational facilities located along Pantai Sabak and Pantai Cahaya Bulan. Northwestward transport of the eroded sediments is resulting in present-day shoreline advance at Pantai Mek Mas and the extension of sand spits and bars in the vicinity of Kuala Besar. It is concluded that the prevailing littoral drift along any coastline has to be taken into consideration prior to the construction of breakwaters and other such engineering structures.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

Technical Session II – Sedimentology, Stratigraphy & Paleontology

THE OCCURRENCE, GENESIS AND CHARACTERISTICS OF PRIMARY KAOLINITIC CLAY OCCURRENCE AT KM 12-13, BUKIT LAMPAS, SPG. PULAI-POS SLIM, IPOH

KAMAR SHAH ARIFFIN, HARYATI ABDUL RAHMAN, HASHIM HUSIN & KAHIRUL ANWAR ABDUL HADI

School of Materials and Mineral Resources Engineering,
Universiti Sains Malaysia
14300 Nibong Tebal

ABSTRACT: The chemical, mineralogical and textural characteristics of the Lampas Kaolin occurrence, near Simpang Pulai Ipoh and its genesis were investigated by X-ray diffraction (XRD), Differential Thermal Analysis (DTA), Thermo gravimetric analysis (TGA), Scanning Electron Microscope (SEM), Fourier Transform Infra-red (FTIR) and X-ray Fluorescence (XRF) analysis, Energy Dispersive X-ray (EDX) and Malvern Mastersizer. A preliminary attempt to evaluate its potential as an industrial raw material was carried out, including particle size analysis, moisture content, LOI, chemical composition, plasticity characteristics, firing shrinkage, brightness/whiteness and modulus of Rupture (MOR). Field evidence supported by mineralogical, granulometric, and chemical analyses suggest that the Lampas kaolin is a product of both hydrothermal and in-situ weathering of sugary aplite, leucomicrogranite, pegmatites and medium to coarse-grained, porphyritic granites of the area. Numerous occurrences of quartz-feldspar veins stockworks, silicification and illite alteration (argillic zone) were evident and characteristic of hydrothermal fluid influx system of the area. Kaolinite is the predominant clay mineral of the Lampas kaolin occurrence with quartz, feldspar and illite/muscovite occurring as subordinate and alteration minerals. Localized occurrence of halloysite is also evident. Widespread, red, orange, or brown of the more stable, lateritic clay saprolite characterizes the near surface overburden. The alumina content of Lampas Kaolin occurrence is generally between 28-34%, where impurities particularly iron oxide < 0.2% and total alkali and titania account for less than 1%. The average total alkali and iron contents are about 0.7% and 0.2% respectively. The average dry powder moisture and LOI is 1.25% and 14.0% respectively. The shrinkage and MOR values of the Lampas crude clay are moderate at lower temperatures, mainly due to its lower alkali and iron contents with over 45% (D_{45}) below the 2μm fraction and of superb whiteness/brightness, however with a lacking workability index.

Keywords: Kaolin, clay mineral, industrial clay, kaolinite and clay genesis

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

SOME DEEP WATER MIDDLE TRIASSIC FORAMINIFERA FROM THE SEMANGGOL FORMATION

BASIR JASIN

Pusat Pengajian Sains Sekitaran dan Sumber Alam
Universiti Kebangsaan Malaysia

ABSTRACT: Eight benthic foraminiferal taxa were retrieved from siliceous mudstone samples collected from the Semanggol Formation at Bukit Lada and Merbau Pulas. The foraminifera consist of *Pseudonodosaria densa, Pseudonodosaria lata, Psuedonodosaria obconica, Pseudonodosaria simpsonensis, Prodentalina* sp A, *Prodentalina* sp B, *Cryptoseptida* sp., and *Protonodosaria* spp. The assemblage indicates that the depositional environment was a deep marine basin above the calcite compensation depth.

ABSTRAK: Lapan taksa foraminifera bentos telah didapatkan semula daripada sampel batu lumpur bersilika yang dikutip dari Formasi Semanggol yang tersingkap di Bukit Lada dan Merbau Pulas. Foraminifera terdiri daripada *Pseudonodosaria densa, Pseudonodosaria lata, Psuedonodosaria obconica, Pseudonodosaria simpsonensis, Prodentalina* sp A, *Prodentalina* sp. B., *Cryptoseptida* sp., dan *Protonodosaria* spp. Himpunan ini menunjukkan sekitaran pengendapannya merupakan sekitaran lembangan samudera dalam di atas kedalaman pampasan kalsit.

EXCEPTIONAL PRESERVATION OF CORALS AND MOLLUSCS BY IRON OXIDE REPLACEMENT IN HOLOCENE BEACH ROCK, PULAU SIBU, JOHORE, PENINSULA MALAYSIA

LEE CHAI PENG & NUR ISKANDAR TAIB

Department of Geology
University of Malaya
50603 Kuala Lumpur

ABSTRACT: Large tracts of coral that have been preserved by pseudomorphic replacement with goethite were found on beaches around Pulau Sibu, an island consisting of calc-alkaline tuffs off the coast of Johore in Peninsula Malaysia. The iron is brought to the sites of replacement by joints and fractures in the volcanics, and whether replacement takes place at a given locality may be controlled by the local flow regime of percolating groundwater through the pile of chemically unstable tuff. The actual replacement may be related to an increase in iron activity due to surface evaporation, since the layers of replaced coral resemble hard iron oxide crusts found in soils.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

NEOCOMIAN PALYNOMORPH ASSEMBLAGE FROM CENTRAL PAHANG, MALAYSIA

UYOP SAID, MARAHIZAL MALIHAN & ZAINEY KONJING

Geology Programme
School of Environmental and Natural Resource Sciences
Faculty of Science and Technology
Universiti Kebangsaan Malaysia

ABSTRACT: The rock successions exposed at several road-cuts along the road connecting Triang and Paloh Hinai in the central part of Pahang yield a distinct palynomorph assemblage which dominated by fairly-well preserved significant palynomorph species namely *Cicatricosisporites australiensis*, *C. ludbrookiae*, *Biretisporites eneabbaensis* and *Baculatisporites comaumensis*. Based on the occurrence of the total palynomorphs, the identified assemblage shows some similarities with that of *Stylosus* Assemblage and the succeeding *Speciosus* Assemblage of Lower Cretaceous age. The presence of certain stratigraphically significant palynomorph permits the assignment of chronostratigraphic age of this assemblage to the lowest *Speciosus* Assemblage of Valanginian- Hauterivian (Neocomian).

ABSTRAK: Jujukan batuan yang tersingkap di beberapa potongan jalan yang menghubungkan Triang dan Paloh Hinai di bahagian tengah Pahang mengandungi himpunan palinomorf yang didominasi oleh *Cicatricosisporites australiensis*, *C. ludbrookiae*, *Biretisporites eneabbaensis* dan *Baculatisporites comaumensis* yang terawet hampir sempurna. Berdasarkan kepada kehadiran keseluruhan palinomorf, himpunan yang dikenal pasti menunjukkan persamaan dengan Himpunan *Stylosus* dan Himpunan *Speciosus* yang menindih di bahagian atasnya berusia Kapur Awal. Kehadiran palinomorf yang khusus pada pada usia stratigrafi tertentu telah membolehkan usia himpunan ini diletakkan di bahagian terbawah Himpunan *Speciosus* yang berusia Valanginian- Hauterivian (Neocomian).

SEDIMENTOLOGICAL AND PALAEONTOLOGICAL STUDIES ON THE KUBANG PASU FORMATION FROM WANG KELIAN AREA, PERLIS

RAHIDA EMBI, UYOP SAID & KADDERI MD. DESA

Geology Programme
School of Environmental and Natural Resource Sciences
Faculty of Science and Technology
Universiti Kebangsaan Malaysia

ABSTRACT: Sedimentological and palaeontological studies of the Kubang Pasu Formation (Late Devonian-Early Permian) have been carried out along the road from Kaki Bukit to Kampung Wang Kelian which is located in the northwestern Perlis. The rock succession of The Kubang Pasu Formation in this area represents the bottommost part of the formation which is conformably overlying the Setul Limestone Formation (Ordivision-Silurian). It can be divided into four facies namely the mudstone interbedded with fine-grained sandstone facies, red mudstone facies, black mudstone facies and mudstone interbedded with shale which were deposited in marine environment of the Early Carboniferous-Permian age. Several fossils such as *Posidomnya* sp. of Early Devonian-Early

Carboniferous age were found in the red mudstone facies. From the palynological study, several stratigraphically long ranging fungal spores have been identified i.e *Dyadosporites* sp., *Monoporisporites minutus*, *Hypoxylonites brazosensi* and *Portalites confertus*.

ABSTRAK: Kajian sedimentologi dan paleontologi telah dijalankan terhadap Formasi Kubang Pasu (Devon Akhir-Perm Awal) di sepanjang jalan dari Kaki Bukit ke Wang Kelian yang terletak di barat laut Perlis. Jujukan batuan di sini merupakan bahagian paling bawah Formasi Kubang Pasu yang menindih Formasi Setul (Ordovisi Awal-Devon Awal) secara selaras dan terdiri daripada empat fasies iaitu fasies batu lumpur berselang lapis dengan batu pasir halus, fasies batu lumpur merah, fasies batu lumpur hitam dan fasies batu lumpur berselang lapis dengan syal yang ditafsirkan telah terendap di sekitaran laut. Di dalam fasies batu lumpur merah telah ditemui beberapa fosil seperti *Posidomnya* sp. berusia Devon Atas-Karbon Awal. Hasil daripada kajian palinologi yang dilakukan, beberapa spora fungi yang berjulat usia panjang telah dikenal pasti iaitu *Dyadosporites* sp., *Monoporisporites minutus, Hypoxylonites brazosensis* dan *Portalites confertus.*

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

Technical Session III – Environmental Geology

GEOSCIENCE IN LANDUSE PLANNING FOR ENVIRONMENTAL SUSTAINABILITY

JOY JACQUELINE PEREIRA & IBRAHIM KOMOO

Institute for Environment and Development (LESTARI)
Universiti Kebangsaan Malaysia

ABSTRACT: The Selangor State Policy on Environmentally Sensitive Areas (ESAs) was officially launched on 5 June 1999. Three types of ESAs are identified. These are ESAs for Heritage Value, ESAs for Life Support Systems and ESAs associated with Hazards. The paper aims to highlight the importance of geoscience in landuse planning, particularly through the Selangor Policy on ESAs. The issues and challenges in contributing effectively to ensure environmental sustainability are discussed in this context.

ABSTRAK: Dasar Kawasan Sensitif Alam Sekitar (KSAS) Selangor telah dilancarkan pada 5 Jun 1999. Tiga jenis KSAS telah dikenalpasti iaitu KSAS Nilai Warisan, KSAS Sokongan Hidup dan KSAS Risiko Bencana. Kertas kerja ini membincangkan kepentingan geosains dalam perancangan gunatanah, terutamanya melalui Dasar KSAS Selangor. Isu dan cabaran dalam menyumbang secara berkesan bagi memenuhi tuntutan kelestarian alam sekitar dibincang dalam konteks tersebut.

SIX-YEAR RECORD OF RATE OF LIMESTONE DISSOLUTION IN AT THREE SITES IN GUNUNG RAPAT, KINTA VALLEY, PERAK, MALAYSIA

ROS FATIHAH MUHAMMAD

Department of Geology
University of Malaya
50603 Kuala Lumpur

ABSTRACT: Dissolution rate of limestone in the Kinta Valley is continuously measured. The last measurement before this study is done was taken in 2001. The whole six years has shown that limestone is further being degraded under natural environment. The estimated dissolution on the limestone bedrock is from 0.086 to 0.158 mm/yr. However it is too early for the author to conclude that extrapolation of short term micro erosion meter data is acceptable in this environment.

ABSTRAK: Kadar pelarutan batu kapur di Lembah Kinta diukur secara berterusan. Ukuran yang terakhir sebelum kajian ini dibuat pada 2001. Masa 6 tahun ini menunjukkan yang batu kapur terus mengalami pelarutan di dalam keadaan semulajadi. Pelarutan dianggarkan dari 0.086 ke 0.158 mm/tahun. Walaubagaimanapun, masih terlalu awal bagi penulis untuk membuat kesimpulan yang data jangka masa pendek yang diperolehi dari meter erosi mikro boleh diramalkan untuk masa akan datang.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

Technical Session IV – Structural Geology & Conservation

GEOSCIENCE IN THE QURAN 3; "GEOSCIENCE IN THE QURAN"- AS A SUBJECT AT UNIVERSITY LEVEL FOR GEOSCIENTISTS

MOKHTAR GHANI

Geology Department, University of Malaya, 50603 Kuala Lumpur, Malaysia.

ABSTRACT: Since 1998/99, the Ministry of Education of Malaysia has made it compulsory for all university students to pass the subject, "Tamadun Islam dan Tamadun Asia (TITAS)", i.e. Islamic Civilization and Asian Civilization before they can graduate. However, TITAS teaches only Islamic civilization. Islamic Quranic knowledge can be extended to the field of sciences. It has been highlighted during the last two GSM Annual Conferences (2004 and 2005) that many Quranic verses show beneficial knowledge related to geoscience. It is considered important that university students studying geoscience and other related courses should be encouraged to know what the Quran says about geoscience and be blessed with the knowledge gained. Some comments by well known scientists are given. Examples are also given where related Quranic knowledge are being taught in other disciplines (medicine, engineering and architecture, etc). It is proposed that "Geoscience in the Quran" should be introduced as an elective subject at university level, for all geoscience students and possibly, made compulsory for Muslim students.

ABSTRAK : Semenjak 1998/99, Kementerian Pendidikan Malaysia telah menwajibkan kepada semua pelajar-pelajar universiti tempatan lulus dalam matapelajaran "Tamadun Islam dan Tamadun Asia (TITAS)", sebelum mereka mendapat ijazah masing-masing. Walau bagaimana pun, didalam TITAS hanya diajar perkara-pekara yang berkaitan dengan tamadun sahaja. Didalam Quran boleh juga didapati ilmu-ilmu yang berkaitan dengan sains. Pada dua Persidangan Tahunan GSM yang lepas (2004 dan 2005), telah diterangkan ayat-ayat Quran yang memberi ilmu-ilmu yang bermanafaat tentang geosains Ilmu-ilmu ini sangat penting untuk pelajar-pelajar geosains dan kursus-kursus berkaitan diuniversiti supaya mereka mendapat keberkatan. Beberapa contoh pendapat saintis-saintis terkemuka telah diberi. Contoh-contoh juga diberi dimana ilmu-ilmu Quran diajar bersama didalam bidang lain seperti perubatan, kejuruteraan dan senibina. Amatlah baik sekiranya matapelajaran "Geosains didalam Quran" dapat diperkenalkan diuniversiti sebagai matapelajaran pilihan. Lebih baik lagi jikalau ia diwajibkan keatas pelajar-pelajar muslim.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

PENILAIAN GEOKEPELBAGAIAN DI PULAU ANAK BURAU, LANGKAWI

(THE ASSESSMENT OF GEODIVERSITY OF ANAK BURAU ISLAND, LANGKAWI)

TANOT UNJAH & IBRAHIM KOMOO

Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia

ABSTRAK: Pulau Anak Burau yang terletak di hujung tanjung antara Teluk Burau dan Teluk Kok merupakan satu-satunya pulau baki yang terbentuk daripada batuan granit di Kepulauan Langkawi. Pulau yang terbentuk membujur dengan ketinggian sekitar 15m ini membentuk pantai berbatu yang meluas dan mempamerkan kepelbagaian geologi yang tinggi terutamanya kepelbagaian batuan, kepelbagaian struktur dan rupabumi. Kepelbagaian batuan meliputi granit porfiri bersaiz sederhana dan kasar, granit berbutir halus (aplit), pegmatit dan diorit. Kepelbagaian struktur meliputi kehadiran xenolithos, telerang, daik, sesar dan sistem kekar. Kepelbagaian batuan dan struktur dibantu oleh proses sekitar pantai telah mempengaruhi pembentukan landskap pantai berbatu yang menunjukkan kepelbagaian rupabumi dan fitur geomorfologi yang tinggi. Antaranya ialah teres hakisan laut, tebing curam dan pembentukan bongkah pelbagai saiz. Salah satu fitur geomorfologi yang luarbiasa dipersisiran pulau ini ialah fitur 'seakan-karren' yang berkembang baik dipermukaan batuan granit hasil interaksi proses ombak, aliran pasang-surut, corak struktur dan komposisi batuan.

ABSTRACT: Anak Burau Island, situated at the tip of the headland between Burau bay and Kok Bay, is the only residual granite island in Langkawi. The island is oval shaped with the highest point at about 15m, forming an extensive rocky beach, which displays rock, structure and landscape geological diversities. Rock diversity includes porphyritic granite from medium to coarse grains including fine granite (aplite), pegmatite and diorite. Structural diversity includes xenolithes, veins, dyke, fault and joint systems. Rock and structure diversities assisted by sea erosion form the rocky beach with high landscape and geomorphological diversity. Among those features observed are marine platform, cliffs and various sizes of boulders. One of the outstanding geomorphological features observed along the coast of the island is a well develop 'karren-like' feature on the granite surface, which was formed by waves and tidals processes and added by structural pattern and composition of the rock.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

CLIMATE CHANGE: CONTRIBUTION OF GEOSCIENCES AND LOOKING AT THE PRESENT TREND

KAMALUDIN HASSAN

Minerals & Geoscience Department Malaysia, Sarawak
Jalan Wan Abdul Rahman, Kenyalang Park, Peti Surat 560, 93712 Kuching
kamaludin@jmg.gov.my

ABSTRACT: Climate change has been depicted throughout the earth's geological history. Phases of warm and cool global climates have been indicated since the Cambrian times. The Quaternary, even though a comparatively very short lapse within the geological time scale, has recorded staggering periods of cold and warm phases. Glacial and interglacial cycles alternate with interspersed interstadial periods. However, the climate trend presently of much concerned is the alarming revelation since the Industrial Revolution. Climate variables measurements are extracted from diverse climate proxy records from various geosciences techniques. Fossils, sediments and isotopic evidences form among sources of information of the past environments. The impact of modern times on climate reflects the consequence of human indulgence on his environment.

ABSTRAK: Perubahan cuaca dunia telah diketahui sepanjang sejarah geologi. Sejak masa Kambrian lagi cuaca dunia diketahui telah melalui fasa-fasa panas dan dingin. Di masa Kuaterner pula, walaupun suatu masa yang pendek di dalam geologi, rekod menunjukkan telah berlaku banyak fasa sejuk dan panas. Fasa *glacial* dan *interglacial* telah di selang-seli dengan masa *interstadial*. Walaupun demikian, sejak berlakunya *Industrial Revolution* cuaca berada pada tahap membimbangkan dan perlu dititikberatkan. Pengukuran variasi cuaca adalah didapati dari rekod wakil cuaca pelbagai teknik geosains. Fosil, sedimen dan bukti isotop menjadi di antara punca maklumat kepada persekitaran kuno. Pemodenan yang dihasilkan dari aktiviti manusia sehingga kini telah memberi kesan kepada keadaan cuaca yang dialami.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

Technical Session V – Petrology and Geochemistry

DIORIT KOMPLEKS IGNEUS LANCHAR, PAHANG: PERBANDINGAN PETROGRAFI DAN GEOKIMIA DENGAN DIORIT KOMPLEKS IGNEUS BENOM

MOHD ROZI UMOR[1], AZMAN ABD. GHANI[2], HAMZAH MOHAMAD[1] & GOH SWEE HENG[1]

[1]Program Geologi, Pusat Pengajian Sains Sekitaran dan Sumber Alam, Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia, 43600 BANGI, SELANGOR
[2]Jabatan Geologi, Fakulti Sains, Universiti Malaya, 50603 KUALA LUMPUR

ABSTRAK : Perbandingan diorit Kompleks Igneus Lanchar dan diorit Kompleks Igneus Benom dilakukan secara petrografi dan geokimia bagi mengetahui hubungan antara kedua kompleks ini. Kandungan mineral kedua-dua diorit adalah berbeza terutama mineral aksesori. Perbezaan lebih ketara diteliti terhadap tekstur mineral seperti warna, saiz butiran dan orientasi. Ini disokong oleh taburan geokimia yang menunjukkan kedua-dua diorit tidak membentuk tren Gambar Rajah Harker yang baik dan selari tetapi terkelompok kepada dua kumpulan yang berbeza. Oleh itu, kedua-dua diorite daripada kompleks ini ditafsirkan berbeza dari segi petrografi dan geokimia.

ABSTRACT: Comparative study between diorite from Lanchar Igneous Complex and Benom Igneous Complex was done based on petrographic and geochemistry to show the relationship between these complexes. Both diorites have a different mineral composition especially the accessory mineral. The clear differentiation shows by textures such as colour, grained-size and orientation of mineral. The geochemistry distribution also indicated that both diorites are different, showing by their poor trend of the Harker Diagram which is separated into two groups. As the conclusion, both diorites are differed to each other based on petrographic and geochemistry.

BATUAN VOLKANO DARI PULAU TINGGI DAN PULAU SIBU, JOHOR

AZMAN A GHANI

Department of Geology, University of Malaya, 50603 Kuala Lumpur

ABSTRACT: Sibu and Tinggi islands are two of a group of volcanic islands off Johore's east coast. Tinggi Island consists of tuffs, with clast sizes ranging from several mm to 6 cm. Sibu Island, on the other hand, is made up of unconsolidated, interbedded from ash to sand-sized tuff and thin flows of felsic lava.

ABSTRAK: Pulau Sibu dan Pulau Tinggi merupakan dua buah pulau di dalam gugusan kepulauan timur Johor. Kedua-dua pulau ini dibentuk oleh batuan volkanik jenis piroklas. Pulau Tinggi terdiri dari batuan piroklas jenis tuff yang mempunyai klas klas berjulat dari beberapa mm ke 6 sm. Ia berasosiasi dengan batuan riolit. Pulau Sibu pula terdiri dari batuan piroklastik yang tak konsolidat dan dicirikan oleh saling terlapis tuf bersaiz debu ke pasir dan lapisan lava felsik yang nipis.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

K-RICH BASALT IN THE BUKIT MERSING AREA, THIRD DIVISION, SARAWAK

NUR ISKANDAR TAIB

Department of Geology, University of Malaya, 50603 Kuala Lumpur
ntaib@alumni.indiana.edu

ABSTRACT: The basalts exposed near Bukit Mersing, Sarawak are early Eocene in age, and lie conformably over the highly folded, imbricated metasediments of the Rajang Group. Initially thought to be ophiolite, it lies close to the "Tatau-Bukit Mersing Line", which was thought to be a major thrust fault or terrane suture, containing obducted ocean floor material. The one analysis published in 1957 showed a K_2O value of 2.82%, too high for ocean floor basalt produced at a spreading center. New analyses confirm that K contents in these rocks are high. The K is hosted in K-feldspar rims around plagioclase phenocrysts. Based on the chemistry, and on field relationships, the Tau Range basalt is not ophiolite, but is likely to be Oceanic Island basalt, developed over oceanic crust, caused by short-lived hot spot magmatism.

BATUAN VOLKANIK FORMASI SEMANTAN DI SEKITAR GUNUNG BENOM

MOHD ROZI UMOR[1], AZMAN ABD. GHANI[2] & HAMZAH MOHAMAD[1]

[1]Program Geologi, Pusat Pengajian Sains Sekitaran dan Sumber Alam, Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia, 43600 BANGI, SELANGOR
[2]Jabatan Geologi, Fakulti Sains, Universiti Malaya, 50603 KUALA LUMPUR

ABSTRAK : Batuan volkanik Formasi Semantan yang terdapat di sekitar Gunung Benom telah dikaji secara petrografi dan geokimia untuk mengetahui kandungan mineral dan jujukan penghabluran yang berlaku. Tiga jenis batuan dikenali sebagai tuf riolit, tuf riolit porfiri kuarza dan trakit-andesit telah dijumpai. Kajian petrografi menunjukkan ketiga-tiga batuan mempunyai tekstur batuan yang berbeza, iaitu tuf riolit bersaiz hampir sama butiran dengan saiz halus, tuf riolit porfiri kuarza bertekstur porfiri sangat baik dengan taburan saiz bimodal yang jelas dan trakit-andesit bertekstur porfiri agak jelas dengan pelbagai saiz mineral mewujudkan tekstur seriat. Geokimia menunjukkan batuan ini dikelaskan sebagai siri sub-alkali atau tholitik.

ABSTRACT: Volcanic rock within the Semantan Formation at the vicinity of Gunung Benom has been study through petrographic and geochemistry to reveal their mineral composition and sequence of crystallization. Three rock types are defined as rhyollite tuff, quartz phorpyhritic rhyollite tuff and trachy-andesite was found. The petrographic study shows that all rocks has a different texture, which is rhyollite tuff shows an isogranular texture with fine grain-sized distribution, quartz phorphyritic rhyollite tuff shows the excellent phorphyritic texture with clear distinction into a bimodal size distribution and trachy-andesite depicted the moderate phorphyritic texture with the seriat texture shows by various grain-size mineral distribution. The geochemistry indicated that this rock can be classified as sub-alkali series or thoieelite series.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

THE MINERALOGY OF GOLD MINERALZATION OF AJMAL MINE, KECHAU TUI, PAHANG DARUL MAKMUR

WAN FUAD WAN HASSAN

Program Geology, Faculty of Science and Technology, National University of Malaysia, 34600 Bangi, Selangor, Malaysia

ABSTRACT: The former Ajmal Mine, presently a limestone quarry, shows gold mineralization in its quartz veins. The veins are steeply dipping to the west, are fault related and may occur singly or in multiple as parallel veins in shear zones. The gold bearing veins are sulphide- poor. In some veins, gold mineralization is associated with tetrahedrite. Galena-rich patches, carrying almost nothing else, may also be found in the gold bearing quartz veins but it is a late mineral. Texturally gold is fine-grained and is found in the quartz and in the tertrahedrite. Wall-rock alteration is hardly visible and the only type associated is silicification. From the mineralogy and wall-rock alteration it is likely that deposition occurred at a low temperature at a distance from the source of the mineralization.

GOLD MINERALIZATION AND ZONATION IN THE STATE OF KELANTAN

GOH SWEE HENG[1], TEH GUAN HOE[2] & WAN FUAD WAN HASSAN[1]

[1]Geology Program, Centre of Environmental Science and Natural Resource
Faculty of Science and Technology, National University of Malaysia
43600, Bangi, Selangor
[2]Department of Geology, University of Malaya, 50603 Kuala Lumpur

ABSTRACT: Gold mineralization in Kelantan is mainly distributed in the central part of the state, bounded by Stong Igneous Complex and Senting Granite on the west, Kemahang Granite in the north and Boundary Range Granite in the east. The gold mineralization is more common in Triassic sedimentary rocks followed by Permian metasedimentary rocks. The oldest Silurian-Ordovician metasedimentary rocks only contain some insignificant gold mineralization, whilst the youngest Cretaceous-Jurassic sedimentary rocks are devoid of gold mineralization. Basically, the gold mineralizations are identified as volcanogenic massive sulphides, skarns and hydrothermal quartz vein deposits. Six types of hydrothermal quartz veins can be observed, viz; low sulphide quartz veins, high sulphide quartz veins, quartz veins in sheared granite zones, quartz veins at the boundary of sedimentary rocks, structurally controlled quartz veins in volcanic-sedimentary rocks and metamorphic segregation quartz veins. The main factors contributing succession of gold mineralization are source rocks, heating chamber as well as depositional structures. The principal source rocks are Permian-Triassic volcanic rocks that are associated with sedimentary rocks. The heating chamber that induced the hydrothermal fluids is the granitoind bodies that intruded under the volcanic-sedimentary rocks, whilst the structures which allow the infiltration and deposition of gold are shear zones and fault zones originating from depth. Based on the type of ore deposits, geochemical data and geological setting, the study area can be divided into five zones, namely gold zone (hydrothermal veins), gold-base metal zone (volcanic exhalative), gold-silver-mercury zone (hydrothermal veins), base metal-gold zone (massive sulphides) and silver-lead-zinc zone (skarn and massive sulphides).

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

Technical Session VI – Geoscientific Tools & Techniques

2D SEISMIC REFRACTION TOMOGRAPHY SURVEY ON METASEDIMENT AT A PROPOSED DEVELOPMENT SITE IN DENGKIL, SELANGOR

UMAR HAMZAH & ABD RAHIM SAMSUDIN

Program Geologi, Fakulti Sains & Teknologi, Universiti Kebangsaan Malaysia

ABSTRACT: A geophysical survey using seismic refraction technique was carried out at a proposed development site at MINT-Dengkil. The aim of the study was to characterize the subsurface materials based on seismic P-S wave velocities as well as to correlate those data with the lithologic logs and the standard penetration test (SPT) N-values. The study area is about 40 km squares, consisting of shale, slate and siltstones of the Kenny Hill Formation. Seismic surveys were carried out using ABEM MK 3 as a recording seismograph, and 24 units of 14Hz-frequency geophones 'to record the incoming seismic waves. The data were processed using an OPTIM software to produce sections of 2D velocity model profiles. Results show P-wave velocity of clayey silt (SPT=3-11) is ranging from 300-500m/s and S-wave velocity is ranging from 80-100m/s. P-wave velocity value for sandy silt (N=12-16) is ranging from 500-800m/s and S-wave velocity is found ranging from 100-300m/s. P-wave velocity value representing hard silt with gravel (N=20-50) is ranging from 900-1600m/s and S-wave velocity is ranging from 300-450m/s. The S-wave velocity obtained from seismic surveys show only slight difference in values compared with those calculated using SPT N values. The calculated Poisson ratio value ranging from 0.43-0.47, representing clayey-silt and sandy-silt. Velocity model sections were correlated well with the lithologic and SPT N values at each borehole. In the study area, the SPT test was terminated when the N value reached 50 which correspond to the hard gravelly silt soil. The SPT test was only conducted in soft soil zone without penetrating the bedrock, whereas for the seismic survey, some of the 2D velocity model cross sections show P-wave velocity values range from 3500 to 4000m/s at a depth of more than 15m. This high velocity values can be interpreted as representing slightly weathered to fresh rock.

PENCIRIAN SIFAT TANAH BAKI GRANIT DI SEKITAR KAWASAN CHERAS, KAJANG DAN KUALA KUBU BHARU, SELANGOR

DAYANG HASSPARIAH SAPRI & WAN ZUHAIRI WAN YAACOB

Program Geologi, Pusat Pengajian Sains Sekitaran & Sumber Alam, Fakulti Sains & Teknologi,

Universiti Kebangsaan Malaysia, 43600 UKM, Bangi, Selangor D.E.

ABSTRAK: Analisis sifat fizikal tanah bagi tiga jenis tanah granit telah dijalankan di sekitar kawasan Selangor. Kawasan kajian tertumpu kepada Kuala Kubu Bharu (KKBG), Kajang Perdana (KPG) dan Taman Bukit Permai (TBPG). Tiga sampel batuan dan sembilan sampel tanah yang mewakili gred luluhawa VI telah dikaji. Sifat fizik yang dikaji ialah graviti spesifik, Had Atterberg, taburan saiz butiran, pengelasan tanah, ujian pemadatan dan ujian ketertelapan. Selain itu, kajian petrografi dan ujian kolum turasan juga dibuat untuk mencari perkaitan dengan kesemua sifat fizik tanah yang dikaji. Dari keputusan analisis menunjukkan ketumpatan bandingan bagi semua sampel hampir sama (Gs=2.65). Nilai had cecair bagi ketiga-tiga jenis tanah granit terletak di antara 36 – 60 %. Tanah KKBG dan KPG mempunyai nilai had cecair melebihi 50 % yang menunjukkan penjerapan air yang tinggi. Taburan saiz butiran untuk semua sampel pula menunjukkan saiz pasir hingga lempung sahaja. Tanah KKBG dan KPG mengandungi saiz lodak dan lempung yang tinggi. Butiran halus yang dominan ini boleh dikelaskan sebagai lodak dengan keplastikan tinggi (MH). Tanah TBPG pula dikelaskan sebagai lodak dengan keplastikan rendah (ML). Dari ujian pemadatan didapati ketumpatan kering maksimum memperlihatkan nilai yang agak tinggi iaitu 1.44 – 1.76 g/cm^3 manakala kandungan air optimum adalah antara 14 - 18 %. Analisis XRD menunjukkan kandungan mineral kaolinit merupakan kandungan mineral utama ketiga-tiga jenis tanah ini. Ujian kolum turasan menunjukkan nilai ketertelapan terletak di antara 1.76 x 10^{-9} – 9.35 x 10^{-8} ms^{-1}. Kesemua tanah granit ini mempunyai sifat fizik yang berbeza. Berdasarkan kajian petrografi , sifat fizik tanah berkait secara langsung dengan jenis batuan granit dan komposisi mineralnya.

ABSTRACT: Soil physical properties of three samples of residual granitic soil in Selangor have been investigated. These samples were collected from Kuala Kubu Bharu (KKBG), Kajang Perdana (KPG) and Taman Bukit Permai (TBPG). In total, three samples of rocks and nine samples of residual soils representing weathered grade VI have been selected for the study. Physical properties consist of specific gravity, Atterberg limits, particle size distribution, soil classification, compaction and permeability. In addition, petrography analysis and column test have been used for comparison purposes. Specific gravity tests showed that all samples have approximately the same density (Gs=2.65). The liquid limit values for all samples ranging from 36-60%. KKBG and KPG showed high water absorption based on the values of liquid limit, which were exceeded 50%. Particle size distribution showed that all samples contain clay, silt, and sand. KKBG and KPG contain higher silt and clay compared to TBPG. They were classified as silt with high plasticity (MH), while TBPG was classified as silt with low plasticity (ML). Compaction test showed maximum dry density of 1.44 to 1.76 g/cm^3 with optimum water content within 14-18 %. XRD analyses showed that mineral kaolinite is abundant in all soils. The permeability values from column test for all samples are ranging from 1.76 x 10^{-9} – 9.35 x 10^{-8} ms^{-1}. All samples showed different physical properties. The petrography analysis revealed that the physical properties are found to be related to the types of granitic rock and their mineral compositions.

KEBERKESANAN KAEDAH KEBERINTANGAN GEOELEKTRIK DALAM KAJIAN RERONGGA DAN PENCEMARAN LNAPL BAWAH PERMUKAAN

TAN CHIN LEE, ABDUL RAHIM SAMSUDIN & UMAR HAMZAH

Pusat Pengajian Sains Sekitaran dan Sumber Alam
Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia, 43000 Bangi.
tanchinlee80@yahoo.com

ABSTRAK: Kajian keberintangan geoelektrik secara pengimejan dan pemprofilan dua matra telah digunakan dalam kajian model rerongga (cavity) buatan dan pencemaran bahan LNAPL (Light Non-Aqueous Phase Liquids) di bawah permukaan. Kaedah pengimejan elektrik telah digunakan untuk melihat keberkesanannya dalam menentukan kedudukan model rerongga dengan menggunakan alat ABEM Terrameter SAS 1000. Sebanyak lima garis survei geoelektrik dengan tiga susunatur yang berlainan iaitu susunatur Wenner, Schlumberger dan Dipole-dipole telah dibuat di atas model rerongga tersebut. Hasil kajian menunjukkan susunatur elektrod yang paling baik untuk mengesan rerongga bawah tanah adalah

susunatur Schlumberger. Kesan pencemaran LNAPL bawah permukaan telah dikaji dimakmal dengan menggunakan model tiub plastik berbentuk selinder yang diisi penuh dengan pasir bersih yang telah dipanaskan pada suhu 200°C. Tiga suku bahagian bawah lapisan pasir ditepukan dengan air. Pengukuran keberintangan geoelektrik lapisan pasir daripada permukaan ke dasar tiub dilakukan dengan kaedah pemprofilan geoelektrik menggunakan ABEM Terrameter SAS 300C. Pengukuran keberintangan dilakukan sebelum dan selepas bahan LNAPL (petroleum) dimasukkan kedalam model tiub tersebut. Plot keberintangan melawan kedalaman lapisan pasir jelas menunjukkan dengan tepat kedudukan zon pasir tak tepu air, zon transisi dan zon pasir tepu air serta paras muka air di dalam model tiub pasir yang dikaji. Peningkatan nilai keberintangan secara mendadak di bahagian lapisan pasir yang tak tepu air telah dikesan selepas cecair petroleum dimasukkan kedalam tiub tersebut.

ACCESSIBILITY OF AIR QUALITY OVER USM CAMPUS USING REMOTE SENSING AND GIS TECHNIQUE

H. S. LIM, M. Z. MATJAFRI, K. ABDULLAH & N. M. SALEH

School of Physics, Universiti Sains Malaysia, Minden 11800 Penang, Malaysia.
Tel: +604-6533888, Fax: +604-6579150
hslim111@yahoo.com.sg, mjafri@usm.my, khirudd@usm.my

ABSTRACT: This study was conducted to observe the sky radiation for air quality retrieval from spectroradiometer measurements over USM campus. The objective of this study is to evaluate the performance of a spectroradiometer for providing useful remotely sensed data for air pollution studies. Aerosol optical thickness (AOT) values were derived from the atmospheric transmittance measurements. The concentrations of particulate matters of less than 10 micron (PM10) were collected simultaneously during the acquisition of the atmospheric transmittance measurements using a handheld DustTrak Meter. The relationship between PM10 and AOT values over Penang Island also was investigated in this study. A well known Beer-Lambert-Bouguer law was applied to obtain aerosol optical thickness (AOT) from the atmospheric transmittance. Finally, the PM10 and AOT map was generated using Kriging interpolation technique over USM campus. This study indicates that the spectroradiometer measurements provide useful remotely sensed data for air quality studies.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

THE SORPTION DISTRIBUTION COEFFICIENT (Kd) OF LEAD AND COPPER ON THE SELECTED SOIL SAMPLES FROM SELANGOR

WAN ZUHAIRI WAN YAACOB, ABDUL RAHIM SAMSUDIN & TAN BOON KONG

Program Geologi, Pusat Sains Sekitaran dan Sumber Alam, Fakulti Sains dan Teknologi, Universiti Kebangsaan Malaysia, 43600 Bangi Selangor D.E.

ABSTRAK: Penjerapan logam berat (iaitu Pb and Cu) dalam tanah di Selangor dikaji dengan menggunakan ujian penjerapan berkelompok (BET). Ujian ini dilakukan dalam dua sistem berbeza; iaitu sistem larutan tunggal dan campuran. Isoterma penjerapan dari ujian BET boleh diperjelaskan lagi menggunakan persamaan Langmuir yang kemudiannya digunakan untuk mendapatkan parameter penjerapan, iaitu pemalar taburan (K_d) dan kapasiti penjerapan maksima (A_m). Persamaan Langmuir dipilih kerana ianya berpadanan dengan hasil ujian yang diperolehi (berdasarkan nilai regrasi garis lurus r^2). Kajian ini menunjukkan tanah berbeza mempunyai keupayaan penjerapan yang berbeza untuk logam berat yang berbeza. Nilai K_d adalah berkadar langsung dengan keupayaan penjerapan. Tanah berjerapan tinggi mempunyai K_d yang juga tinggi. Penjerapan logam Pb dan Cu dalam larutan tunggal adalah lebih tinggi dari larutan campuran, ini disebabkan oleh perebutan kepada tapak perlekatan logam-logam tersebut dalam larutan campuran. Nilai K_d untuk Pb dalam larutan tunggal berjulat 36.18 – 334.48 L/g dan untuk Cu berjulat 9.29-66.19 L/g. Dalam larutan campuran, nilai K_d untuk Pb dan Cu adalah lebih kecil berjulat dari 23.13-31.79L/g dan 3.95-18.53 L/g.

ABSTRACT: The sorption of heavy metals (i.e. Pb and Cu) in soils from Selangor was investigated using batch equilibrium test (BET). The test was conducted in two systems, i.e. single and mix solutions. The sorption isotherms from BET were well described by the Langmuir equation which then used to calculate the sorption parameters, i.e. distribution coefficient (K_d) and maximum adsorption capacity (A_m). The Langmuir sorption equation was chosen according to the experimental data that are fitted nicely to the equation (i.e. based on their linear regression values, r^2). The study has revealed that different soils have different sorption capacity for different heavy metals. The K_d values are proportional to the sorption capacity of soils. Soil with high sorption capacity possesses higher K_d value. The sorption of Pb and Cu in single solution is higher than in mix solution, due to competition for sorption sites among heavy metals in mix solution. The K_d values for Pb in single solution ranging from 36.18 – 334.48 L/g and for Cu is 9.29-66.19 L/g. In mix solution, the K_d values for Pb and Cu are smaller ranging from 23.13-31.79L/g and 3.95-18.53 L/g respectively.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

POSTERS

CHARACTERISTICS AND SUITABILITY OF SEMATAN-LUNDU AND SUNGAI SUAI-KUALA NIAH SILICA SAND, SARAWAK, FOR GLASS-MAKING

KAMAR SHAH ARIFFN, RUSYA AZRINA YAHAYA & AZMI HJ. EKI[1]

School of Materials and Mineral Resources Engineering,
Universiti Sains Malaysia, Engineering Campus, 14300 Nibong Tebal
[1]Department of Mineral and Geoscience, 13000 Kuala Lumpur, Malaysia.

ABSTRACT : Silica sand is an essential constituent in all commercial glass-making. It has a high content of silicon dioxide and a very low iron level as required for making high-quality glass products. The aim of this research is to determine the characteristics and suitability of silica sand extracted from several parts of Sarawak to be used for glass-making. Much work has been done on the silica sand deposits in Sarawak by Department of Mineral and Geosciences. Hopefully, with this additional research, the silica sand areas could be commercialized, so that it will further promote silica-sand mining and its related industries in Sarawak. Seven representative samples from Sematan-Lundu and Sungai Suai-Kuala Niah have been obtained from various depths and have been examined. Comprehensive mineralogical, physical and chemical tests were carried out to characterise the quality of these sand deposits in accordance with international standards (MS 710 : 1981 and BS 2975 : 2004). The specific parameters that were studied are silica content, alkali content; Loss on Ignition (LOI), organic matter, nickel and vanadium, aluminium, iron, chromium, copper and cobalt contents, heavy mineral components as well as particle size distribution, shape, refractoriness and sphericity. The study indicates that the natural silica sand deposits in the Sematan-Sungai Suai area, occurring at a depth between 0.5 m and 1.5 m respectively are F, G and H grades and hence are suitable only for lower-end applications for making window panes, containers, green and amber glass, and insulating fibres. The Lundu silica sand and Kuala Niah silica sand (up to 1.2 m thick) are of F and G grades, which are suitable for making green and amber glass and insulating fibre glass. Sand layers below these depths normally are darker in colour due to presence of organic matter, clay minerals and ferruginous minerals that stained quartz sand. Lundu's silica sands may need to be processed further before it can be used as raw material for glass making. Removal of heavy minerals, by magnetic separation as well as particle size screening and classification are essential. Only Sematan's and Lundu's deposits contain a higher percentage (> 35%) of particle size larger than 106µm. Further mineral processing (washing, scrubbing and acid leaching at appropriate temperatures) would enhance silica content and aid in the removal of iron and clay minerals. This is important for high-end application such as for crystal, optical and borosilicate glasses (A to D grades).

Keywords : Industrial mineral deposit, silica sand and glass ceramic

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

DISCONTINUITY CONTROLLED CUT-SLOPE FAILURES ON WEATHERED LOW GRADE METAMORPHIC ROCKS ALONG THE EAST-WEST HIGHWAY, GRIK TO JELI

MUSTAFFA KAMAL SHUIB[1], SAMSUDIN HJ TAIB[1] & MAZLAN ABDULLAH[2]

[1] Jabatan Geologi, Universiti Malaya, 50603 Kuala Lumpur
[2] GAC BUILDERS SDN BHD, 25-1 Jln. Putra Permai 1A,
Equine Park Commercial Centre Equine Park, 43300 Sri Kembangan

ABSTRACT: This paper describes the occurrence and mechanism of discontinuity-controlled cut-slope failures within the residual soil zone and the underlying weathered metasedimentary and metamorphic rocks, drawing on the experience gained from investigations of a number of landslides observed on the cut- slopes of the East-West Highway. These slope failures highlighted the important influence that discontinuities in residual soils and weathered rocks can have on slope stability. The slope movements recognised in the metasedimentary and metamorphic rock slopes along the East-West Highway are: - A) movements of rock-soil cover through: (i) movement of loose soil and weathered fragments, and ii) rotational sliding movements or slumps, B) movements of loosened blocks (rockfalls), C) movement of intact rocks along predetermined planes (slides), D) progressive complex movements. Slope failures are found to be largely controlled by the unfavourable orientation of discontinuities with respect to the slope face compounded by the weathered nature of the rock and the infiltration of water and continuous traffic flow that triggered movement down slope. The occurrence of landslides in slopes, which have been investigated and engineered, may be the result of inadequate attention to structural features in the weathered rock mass during site investigations and construction (design).

PAIRED HOST-ENCLAVE GEOCHEMISTRY OF MAFIC MICROGRANULAR ENCLAVES (MME) IN THE EASTERN BELT GRANITE, PENINSULAR MALAYSIA

AZMAN A GHANI

Department of Geology, University of Malaya, 50603 Kuala Lumpur

ABSTRACT: This paper describes some of the important petrographic characteristics of the mafic microgranular enclaves and their host rock as well as their chemical relationship of the selected granitic rock from the Eastern Belt granite of Peninsular Malaysia. The enclaves are invariably darker coloured and finer grained than the enclosing granitic rocks. They usually have sharp contact with the granitic host. Occurrence of the acicular apatite and quartz-hornblende ocellar textures in the enclave indicates that quenching and hybridism are among the main processes during the cooling of the magmas. The variable geochemical trends in the enclave and their host rocks probably related to the variable degrees of diffusive exchange between the enclave and their host rock magmas during slow cooling.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

FIELD EVIDENCE OF MAGMA MIXING IN PLUTONIC ROCK FROM THE BENOM COMPLEX, CENTRAL BELT OF PENINSULAR MALAYSIA

AZMAN A GHANI.

Department of Geology, University of Malaya, 50603, Kuala Lumpur

ABSTRACT: The alkalic series of the Benom Complex, Pahang, consists of monzonite, syenite and gabbroic rock. The contact between monzonite and gabbroic rock suggest that both magmas are mixed. Evidence of the mixing can be seen at the new roadcut outcrop along the Benta township by-pass such as dispersion of K-feldspar from monzonite in the gabbroic rock. The end stage of this dispersion is the free swimming of K-feldspar individual crystals in the gabbroic material. This structure is interpreted as the result of mechanical transfer during the mafic-felsic magma interaction and mixing event. All these features suggest an origin for the alkalic intermediate rocks of the Benom Complex involving a magma mixing process.

TEXTURAL AND GEOCHEMICAL STUDY OF THE OLDER DYKES FROM PERHENTIAN ISLAND, PENINSULAR MALAYSIA

AZMAN A. GHANI

Department of Geology, University of Malaya, 50603 Kuala Lumpur, Malaysia

ABSTRACT: Textures and relationships observed in the field suggest that the older dykes intruding the Perhentian Kecil Syenite, Perhentian Island, were coeval to their host. Lobate to crenulate contact and necking of the dykes suggest that the dyke magma was injected into mobile, semi solid syenitic magma. Geochemical analyses show that the older dykes have a wide range of SiO_2, between 48.87 – 56.87%.

PERSIDANGAN GEOSAINS NASIONAL 2006
NATIONAL GEOSCIENCE CONFERENCE 2006
12-13 JUNE 2006, ARMADA HOTEL, PETALING JAYA

THE USE OF REMOTE SENSING AND GIS TECHNIQUES AS AN AID TO RETRIEVE LAND SURFACE TEMPERATURE FROM LANDSAT TM OVER ALQISSIM, SAUDI ARABIA

H. S. LIM[1], SULTAN ALSULTAN[2], M. Z. MATJAFRI[1] & K. ABDULLAH[1]

[1]School of Physics, Universiti Sains Malaysia, Minden 11800 Penang, Malaysia.
Tel: +604-6577888, Fax: +604-6579150
hslim111@yahoo.com.sg, mjafri@usm.my, khirudd@usm.my
[2] Remote Sensing Center of Envir. Consultant
ISPRS, commission 7 WG VII/7, Middle East Coordinator
Malaz, Al Nurii St., P.O.Box.92038 Riaydh City 11653, Saudi Arabia.
Tel: +966504890977 Fax: +96614767828
rsensing_2004@yahoo.com

ABSTRACT: This study presents environmental impact assessment and the status of land surface temperature (LST) standard products retrieved from Landsat TM data for AlQassim, Saudi Arabia. The proposed technique employs our developed mono window LST algorithm for retrieving surface temperature from Landsat TM. The land surface emissivity and solar angle values are needed in order to apply these in the proposed algorithm. The surface emissivity values were computed based on the NDVI values. The LST map derived from ATCOR2_T in the PCI Geomatica image processing software was used for algorithm calibration. The results show a high correlation coefficient (R) and low root-mean-square error (RMS) between the LST values retrieved from the proposed algorithm and ATCOR2_T. This study indicates that the proposed algorithm is capable of retrieve accurate LST values and the derived information can be used in the environmental impact assessment for AlQassim area.

APPLICATION OF THE BLOCK THEORY FOR ROCK SLOPE STABILITY ANALYSIS AT HIGHWAY SEMENYIH-SG.LONG (SSL), SELANGOR STATE IN MALAYSIA.

HASWANTO & A. GHANI RAFEK [1]

Department of Mining, University of Trisakti, Jakarta, Indonesia.
haswanto_wa@yahoo.com
[1]Department of Geology, UKM, Bangi, Malaysia.

ABSTRACT: The granitic rock mass which exists along at the highway Semenyih-Sg.Long (SSL), Selangor state in Malaysia contains a number of major discontinuities, and several sets of minor discontinuities. Therefore, the rock engineering problems of high steep rock slopes are somewhat complicated. The major discontinuities were determined and used to perform a block theory based analysis of the rock slope stability. The orientations of the major discontinuities that occur in the researched area have been considered in this analysis. The orientation of the major discontinuities were as follows (dip-direction/dip-angle): J1:36^0/66^0; J2:152^0/60^0; J3:79^0/88^0; J4:117^0/66^0 and the free-face is ff5:105^0/70^0. The block theory analysis was used to determine: 1. The key blocks type and potential key blocks type II of the rock slope. 2. Maximum safe slope angle (MSSA) for the rock cut slope at the Highway Semenyih-Sg.Long. Based on the data analysis, the following types of key blocks were determined: type I (keyblock) is the JPs 1000 and JP1100, and type II (potential keyblock) is JPs 1110. The result showed that the maximum safe slope angle

(MSSA) is 70^0 for the type I (keyblock) and MSSA is 72^0 for the type II (potential keyblock). The cut slope along at the highway Semenyih-Sg.Long (SSL) is not stable because cut slope angle 80^0 and greater than 70^0 and 72^0 within fresh granite, and contains these discontinuities; therefore there is a need for installation of a proper support system in order to maintain the long term stability of this rock slope.

Keyword: Block Theory, Rock Slope Stability, MSSA, Highway Semenyih-Sg.Long, Malaysia.

JURASSIC-CRETACEOUS CONTINENTAL DEPOSITS FROM EASTERN CHENOR, PAHANG.

ZAINEY KONJING, MARAHIZAL MALIHAN & UYOP SAID

Geology Programme, School of Environmental and Natural Resource Sciences
Faculty of Science and Technology, University Kebangsaaan Malaysia

ABSTRACT: A detailed sedimentological study has been carried out on the rock succession which is exposed at several road cuts along the road from Kampung Pejing to Kampung Lotong located in the east of Chenor, Pahang. The studied rock succession can be divided into four sedimentary facies, namely the sandstone with conglomerate lenses facies, the siltstone with minor sandstone facies, the thickly bedded sandstone facies and the interbedded sandstone with siltstone facies. The palaeoenvironments of deposition for each of the facies are described. It shows a close resemblance with the Mangkin Sandstone Formation in The Tembeling Group of Late Jurassic-Early Cretaceous age, which was interpreted to be deposited in an alluvial fan system.

ABSTRAK: Kajian sedimentologi secara terperinci telah dijalankan terhadap jujukan batuan yang tersingkap di beberapa potongan jalan dari Kampung Pejing hingga Kampung Lotong yang terletak di bahagian timur Chenor, Pahang. Jujukan batuan yang dikaji dapat dibahagikan kepada empat fasies iaitu fasies batu pasir dengan kekanta konglomerat, fasies batu lodak dengan sedikit batu pasir, fasies batu pasir berpelapisan tebal dan fasies selang lapis batu pasir dengan batu lodak. Sekitaran pengendapan bagi setiap fasies diterangkan. Jujukan ini mempunyai persamaan yang jelas dengan Formasi Batu Pasir Mangkin dalam Kumpulan Tembeling berusia Jura-Kapur yang ditafsirkan telah terendap di sekitaran kipas aluvium.

DISCOVERY OF LOWER DEVONIAN DACRYOCONARID BED FROM HILL B GUAR JENTIK, PERLIS: ITS SIGNIFICANCE AND IMPLICATIONS

ONG SWANG THENG & BASIR JASIN

School of Environmental Science and Natural Resources, Faculty of Science and Technology,
Universiti Kebangsaan Malaysia,
43600 Bangi, Selangor Darul Ehsan

ABSTRACT: The Lower Devonian dacryoconarid bed has been found in Hill B at Guar Jentik, Perlis. This fossiliferous bed is stratigraphically overlying the biomicritic limestone lenticle, which is located at the lower part of Hill B. Dacryoconarid bed contains *Nowakia acuaria* and *Styliolina* sp. Besides, *Monograptus* sp. and *Plectodonta forteyi* were also found in this layer. *Nowakia acuaria* and *Plectodonta* *forteyi* are important biostratigraphic index fossils indicates the age of dacryoconarid bed is from late Pragian to early Emsian. Dacryoconarids are randomly oriented and abundant at the top of the limestone especially at the contact between the limestone and the dacryoconarid bed. Dacryoconarids are very rare in the middle part of the limestone. This indicates that the limestone bed at Hill B is older than Pragian. It is probably the upper part of the Setul Formation. The Devonian sequence at Hill B represented by thinly_bedded mudstone and dacryoconarid bed suggests a very slow deposition or non-deposition during Middle and Late Devonian.

ABSTRAK: Lapisan dacryoconarid yang berusia Devon Bawah telah dijumpai di Bukit B Guar Jentik, Perlis. Lapisan kaya fosil ini secara stratigrafi menindih kekanta batu kapur biomikrit, yang terletak di bahagian bawah Bukit B. Lapisan dacryoconarid terdiri daripada *Nowakia acuaria* dan *Styliolina* sp. Selain daripada itu, *Monograptus* sp. dan *Plectodonta forteyi* juga dijumpai dalam lapisan ini. *Nowakia acuaria* dan *Plectodonta forteyi* adalah fosil index biostratigrafi yang penting dalam menunjukkan lapisan dacryoconarid berusia dari Pragian Akhir ke Emsian Awal. Dacryoconarids wujud dalam pelbagai orientasi dan banyak di bahagian atas batu kapur terutamanya di sentuhan antara batu kapur dan lapisan dacryoconarid. Dacryoconarids sangat jarang di bahagian tengah batu kapur. Ini menunjukkan lapisan batu kapur di Bukit B adalah lebih tua dari Pragian. Kemungkinan ini merupakan bahagian atas Formasi Setul. Jujukan Devon di Bukit B yang diwakili oleh lapisan nipis batu lodak dan lapisan dacryoconarid mencadangkan pengendapan yang perlahan atau tiada pengendapan semasa Devon Tengah dan Devon Akhir.

A SEDIMENTOLOGICAL STUDY ON THE TEMBELING GROUP IN THE SOUTH OF MARAN, PAHANG.

MARAHIZAL MALIHAN, ZAINEY KONJING & UYOP SAID

Geology Programme, School of Environmental and Natural Resource Sciences
Faculty of Science and Technology, Universiti Kebangsaan Malaysia

ABSTRACT: A sedimentological study was carried out on the rock succession which exposed at several localities along Kg. Lotong-Kg. Resam, located approximately 15km to the south of Maran, Pahang. This rock succession consists of two formations namely the Lanis Conglomerate Formation of predominantly conglomerate and the Mangkin Sandstone Formation of mainly sandstone together with siltstone, mudstone and shale as part of The Tembeling Group. Based on the sedimentological study, it can be divided into six facies, namely the conglomerate facies in the Lanis Conglomerate Formation; fine-grained sandstone facies, interbedded fine-grained sandstone with siltstone facies, interbedded medium-grained sandstone with siltstone facies, interbedded fine-grained sandstone, siltstone and mudstone facies, and siltstone facies in the Mangkin Sandstone Formation. It is interpreted that, the studied rock succession was deposited in a meandering to braided river system.

ABSTRAK: Kajian sedimentologi telah dilakukan terhadap jujukan batuan yang tersingkap di sepanjang Kg. Lotong-Kg. Resam iaitu lebih kurang 15km ke selatan Maran, Pahang. Jujukan batuan ini terdiri daripada dua formasi iaitu Formasi Konglomerat Lanis yang didominasi konglomerat dan Formasi Batu Pasir Mangkin yang umumnya terdiri daripada batu pasir yang dominan, batu lodak, batu lumpur dan syal yang merupakan sebahagian daripada Kumpulan Tembeling. Berdasarkan kepada kajian sedimentologi yang telah dilakukan, jujukan batuan di kawasan kajian dapat dibahagikan kepada enam fasies iaitu fasies konglomerat dalam Formasi Konglomerat Lanis; fasies batu pasir halus, fasies selanglapis batu pasir halus dengan batu lodak, fasies batu pasir sederhana berselang lapis dengan batu lodak, fasies selang lapis antara batu pasir halus, batu lodak dan batu lumpur dan fasies batu lodak yang terdapat dalam Formasi Batu

Pasir Mangkin. Jujukan batuan di sini telah ditafsirkan terendap di sekitaran sungai berliku hingga sungai berburai.

EXTRACTION PROCESS OF CHROMIUM, COBALT AND NICKEL FROM ULTRABASIC SOILS, SABAH

OSAMA TWAIQ[1], HAMZAH MOHAMAD, MOHAMAD MD TAN, ANIZAN ISAHAK, BABA MUSTA & MOHD ROZI UMOR

[1]School of Engineering & Science, Curtin University of Technology, Sarawak campus, CDT 250, 98009 Miri, Sarawak, Malaysia
Geology Programme, Faculty of Science and Technology, University Kebangsaan Malaysia, 34600 Bangi, Selangor, Malaysia

Abstract: Ranau, Sabah has been chosen as the pilot study area due to widely distributed of ultrabasic soils, rather thickness and good accessibility. A total of area approximately 1.1 square kilometers has been mechanically bored through 3 – 20 meters thick in situ soils. The estimated soil reserve is approximately 19.25 million tonnes. The study of the soil by X-ray diffraction technique (XRD) has shown that the original rock is serpentinite, while the soils contain goethite, $FeO(OH)$; phlogopite, $KMg_3(Si_3Al)O_{10}(OH)_2$; gibbsite, $Al(OH)_3$; rutile, TiO_2; faujasite, $Na_2Al_2Si_4.7O_{13.4}xH_2O$; kaolinite $Al_2Si_2O_5(OH)_4$, and malachite $(Cu_2CO_3(OH)_2$. Due to the low percentage of magnesium in the ultrabasic soils, goethite is believed the major host mineral for Cr, Co and Ni. The elemental distributions were also mapped by electron probe microanalyser (EPMA). Elemental analyses using X-ray fluorescence spectrometry (XRF), atomic absorption spectrometry (AAS) have shown that the ultrabasic soils contain 35 – 45 % Fe, 0.8 – 2.2 % Cr, 0.04 – 0.1 % Co and 0.2 – 1.4 % Ni. A modified atmospheric acid leaching method by batch using ceramic ball mill was developed in the current research to decrease contamination, to match the grinding and leaching steps, and to decrease the processing time. Hydrochloric acid was used in the first step of leaching, followed by extraction by sodium metabisulphate. Solid-liquid separation for the leached materials was done on locally designed stainless steel presser filter. The above mentioned analytical techniques were employed to identify the crystalline phases and the chemical composition and to follow the structural modification occurring upon thermal treatment.

GEO ASIA 2006

PETROLEUM GEOLOGY CONFERENCE

14 JUNE 2006

The Kuala Lumpur Convention Centre

The GEO Asia, organised by the Geological Society of Malaysia and supported by The Government of Malaysia, took place on 14 June 2006 and has drawn together leading geoscientists from around the world. This year the Theme is **Asia's New E & P Horizon**. The conference focused on the geocience issues faced in Asia, through the transfer of scientific knowledge and the application of new techniques and technology. The conference will assist those trying to secure the future of Asia's petroleum industry.

GEO Asia has played and will continue to play a significant role in the showcasing of new products and services to the region's geoscience community. More than 100 participating companies such as PETRONAS, Baker Hughes, BGP Inc., Getech, Schlumberger, PT Fairfield Indonesia, the Colombian National Hydrocarbon Agency, IHS and many others were at GEO Asia 2006. There were also 3 National Pavilions from Norway, United Kingdom and the United States of America.

There were over 4,500 trade visitors from across the region. A total of 11 papers were presented together with 5 posters. At the end of the session there was a forum on " G & G Challenges and Opportunities for E & P in the next decade'.

Lau Yin Leong
Editor

GEO Asia 2006 Petroleum Geology Conference
14 JUNE 2006, KUALA LUMPUR CONVENTION CENTRE, MALAYSIA

WEDNESDAY 14 JUNE 2006

ORAL PRESENTATIONS

TIME	TITLE
08:00	**Registration**
09:00	**Welcome Address by Prof Dr Lee Chai Peng (President, Geological Society of Malaysia)**
09:10	**Paper 1: Observations on subtle deformation in the folded foreland, Sarawak, Borneo** *Franz Kessler (SSB)*
09:35	**Paper 2: Mass Transport Deposits of the Northwest Sabah Deepwater: Characterisation from seismic and borehole data** *Sam Algar[1], Chris Milton[1], Paul Crevello[2] & Jon Roestenburg[3] ([1]Murphy Sabah Oil Company, [2]Petrex Asia Group, [3]Geotransformations Pty Ltd)*
10:00	**Paper 3: Impact of tectonic stress variations on Field Development Planning in the Temana and Bayan Fields, Sarawak Basin** *Stuart Smith[1], Isra Yendhi[1], Andy Brehm[2], & David Castillo[2] ([1]PCSB, [2]GeoMechanics International)*
10:25	Coffee Break
10:50	**Paper 4: Seismically driven fractured reservoir characterization** *Abdel Zellou, Ahmed Ouenes, Gary Robinson & Udo Araktingi (Prism Seismic Inc.)*
11:15	**Paper 5: AVO analysis for Direct Hydrocarbon Detection in Field X at Persian Gulf** *Mohammad Ali Riahi & Mohammad Emami Niri (Tehran University)*
11:40	**Paper 6: Shale Chaser – A seismic inversion method to determine the presence of shale barriers for reserves computation considerations** *Vincent W.T. Kong[1] & Jimmy C.S. Ting[2] ([1]PCSB, [2]Fugro-Jason (M) Sdn. Bhd.)*
12:05	**Paper 7: Braid river channel bar identification and description** *Guang-Jun Chen[1] & Wang Helin[2] ([1]Schlumberger, [2]PetroChina)*
12:30	Lunch Break
13:50	**Paper 8: Application of Improved Oil Recovery strategies in Tapis Field, Malay Basin** *Mohd Rohani Elias, Muhammad Aw Yong Abdullah & Samsudin Selamat (EMEPMI)*

GEO Asia 2006 Petroleum Geology Conference
14 JUNE 2006, KUALA LUMPUR CONVENTION CENTRE, MALAYSIA

14:15 **Paper 9: Regional stress state in the Fold Belt area of PNG and fine scale stress variation with implications for drilling, exploration and subsurface reservoir characterization**
Katharine Burgdorff[1], David Castillo[1], Jon Rowse[2], Gavin Douglas[2], Steve Owad-Jones[2], Jurgen Streit[1], Dan Kendrick[3] & Nigel Wilson[2] ([1]GeoMechanics International, [2]Oil Search Limited, [3]3D-Geo)

14:40 **Paper 10: Fault seal and fault stability risk assessments during a Full Field Development Planning: Implications for injection pressures and operational procedures**
Adrian White[1], Jurgen Streit[1], Ralf Napolowski[2] & Robin Hill[2] ([1]GeoMechanics International, [2]BHP Billiton Petroleum)

15:05 **Paper 11: Accurate wellbore geometry logging enhances geomechanical modeling and drilling optimization practices**
Martin Paris & Seehong Ong (Baker Atlas)

15:30 **Forum "G&G Challenges and Opportunities for E&P in the next decade"**

16:30 **Conference ends**

POSTER PRESENTATION

TITLE

Poster 1: Reducing exploration risk and uncertainty in the Gulf of Thailand and on the Khorat Plateau - The role of tectonics, palaeodrainage and Earth System Modelling
John M. Jacques, Paul J. Markwick, Kerri L. Wilson, David G. Wright & Claudia Fintina (GETECH)

Poster 2: An integrated approach on carbonate reservoir evaluation by combining borehole image and NMR logs - A case study in Ordovician carbonate, East China
Hou Huijung[1] & Yun Huayun[2]
([1]Schlumberger, [2]SinoPec)

Poster 3: Near-Real-Time wellbore completion strategies in complex tectonic settings to optimise target drilling and completion
Jurgen Streit[1], Wouter van der Zee[1], Katharine Burgdorff[1], Jon Rowse[2] & Gavin Douglas[2] ([1]GeoMechanics International, [2]Oil Search Limited)

Poster 4: Stess-Dependent Reservoir Properties
Qiuguo Li & Samie Lee (Schlumberger)

Poster 5: Geographic Text Search - A new approach to Information Discovery
Jerry Mazzaferro (MetaCarta Inc.)

GEO Asia 2006 Petroleum Geology Conference
14 JUNE 2006, KUALA LUMPUR CONVENTION CENTRE, MALAYSIA

WELCOME ADDRESS BY PROF. DR LEE CHAI PENG
President, Geological Society of Malaysia

On behalf of the Geological Society of Malaysia, I am pleased to extend a warm welcome to all conference delegates, exhibitors and visitors to the GeoAsia 06 Conference & Exhibition. As this conference was meant to be an avenue for those who missed presenting their papers at the last Petroleum Geology Conference and Exhibition 2005, the big turnout is a welcome surprise to me as we were expecting only a much smaller crowd for this event.

We are confident that the GeoAsia conference under the theme, **"Asia's New E & P Horizon"**, will address a number of issues currently facing the upstream oil and gas industry.

I would like to welcome all our foreign delegates to Malaysia and hope that the GeoAsia Conference & Exhibition provides an opportunity for you to establish new contacts and strengthen your business relationships in Malaysia and the region.

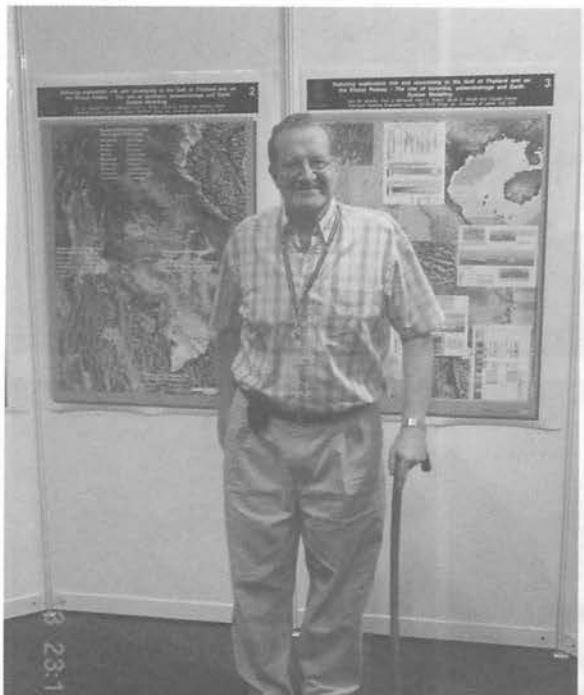
I would like to personally thank the organising committee under Prof. Dennis Tan, Dr. Nur Iskandar Taib who edited the Conference Program and Abstracts and all our conference presenters and delegates for your support. Last but not least, I would like to thank Mr. Ian Roberts and Malaysian Exhibition Services for their generous support without which this conference would not have been held.

I would also like to take this opportunity to invite you to our coming Petroleum Geology Conference and Exhibition to be held here at KLCC on 27 and 28 November 2006.

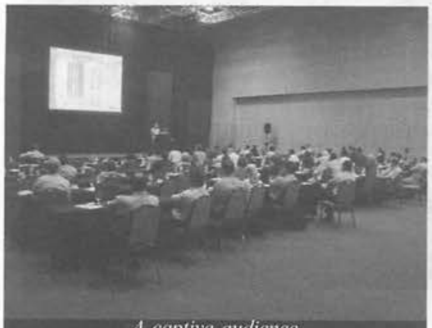
Prof Dr Lee Chai Peng
President, GSM

Photos from
GEO ASIA 2006 PETROLEUM GEOLOGY CONFERENCE


Welcome Address by GSM President, Prof Dr Lee Chai Peng


Prof Emeritus Dr Charles Hutchison - one of GSM's strongest supporter


Prof Dr Lee presenting a souvenir to Prof Dr Wan Hasiah. Looking on is Prof Denis Tan


A captive audience


Participants at the Geo Asia


Participants of GeoAsia

Photos from
GEO ASIA 2006 PETROLEUM GEOLOGY CONFERENCE


Prof Dr Lee presenting a sourvenir to Organising Chairman Prof Denis Tan


Seehong Ong from Baker Atlas emphasising a point


Katharine Burgdorff of Geomechanical International


Organising Chairman Prof Denis Tan with Ajit Menon


Mohd Rohani Elias presenting his paper


Abdel Zellou, Prism Seismic Inc raising a question


Tun Dr Mahathir visiting GSM booth


Katharine receiving a souvenir from Prof Dr Lee


Tun Dr Mahathir at one of the exhibition booth


Adrian White of Geo-Mechanics International

Photos from
GEO ASIA 2006 PETROLEUM GEOLOGY CONFERENCE


GSM & Dept of Geology, UM Booth

GEO ASIA 2006 CONFERENCE


Ajit Menon of Baker Atlas - panel member


Session Chairman Trent Rehill from Murphy Oil


Sam Algar of Murphy Oil


Mohd Rohani Elias of EMEPMI


Posters' display


GSM and Dept of Geology, UM booth


Prof Denis Tan & students


Booth of GSM & Dept of Geology, UM


Schlumberger's booth

Paper 1

Observations on Subtle Deformation in the Folded Foreland, Sarawak, Borneo

Dr. Franz L. Kessler

SSB, Lutong, Malaysia

Neogene tectonics in the foreland of Sarawak responded to major compressive stress directions. The Sundaland areas were compressed (i) between Asia and Australia; and (ii) wedged between Indonesia and the Philippines. Yet the overwhelming amount of compression was taken care by subduction zones along these margins.

From the northern shores of Borneo, both stratigraphic age and tectonic deformation gradually increase toward the interior of the island. Massive compression of Late Miocene age not only shaped the structure of the mountain belts along the border of Sarawak and Kalimantan, it created also several synclines, that were sheared-off and pushed farther onto autochthonous and tectonically undisturbed foreland. This paper discusses the transition zone's character between para-autochtonous imbricates and non-deformed sediments.

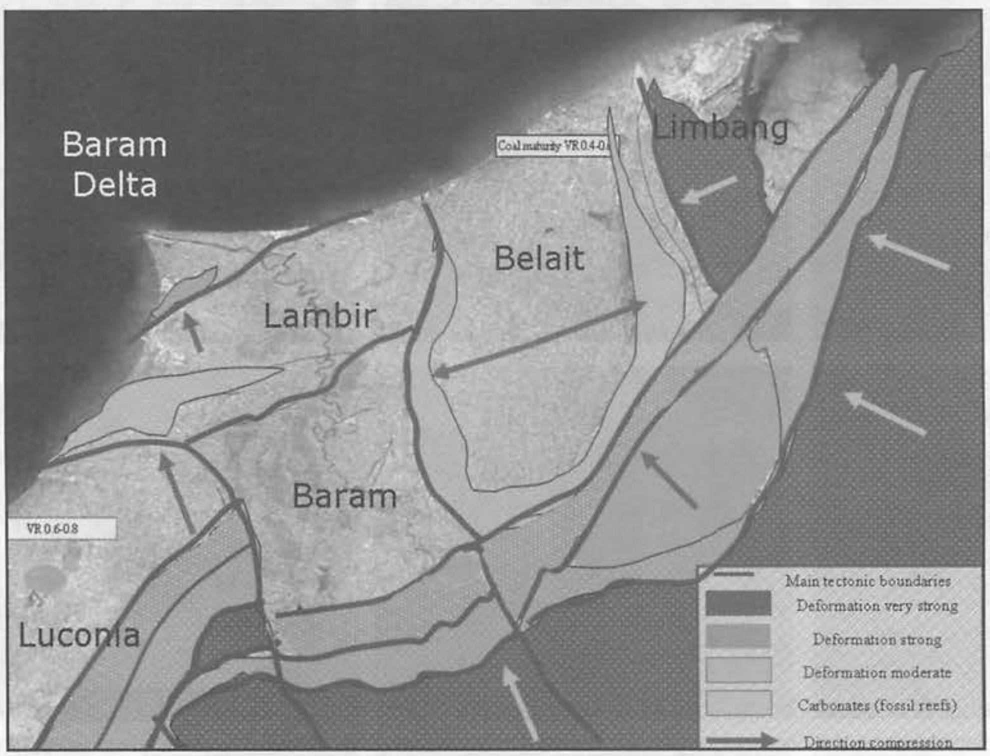


Figure 1: Simplified tectonic sketch of northern Sarawak and Brunei, showing areas with different degrees of deformation. The southern areas in the map shown were compressed already during Palaeogene times.

Satellite pictures (Landsat: Esri and Google Earth) were studied, interpreted and calibrated by field work. Distinction is made between areas of 'very strong deformation', 'strong deformation,' 'moderate deformation,' and un-deformed forelands. Several areas offering outcrops in the transitional forelands were studied in some detail. Some 25 days were spent in the field.

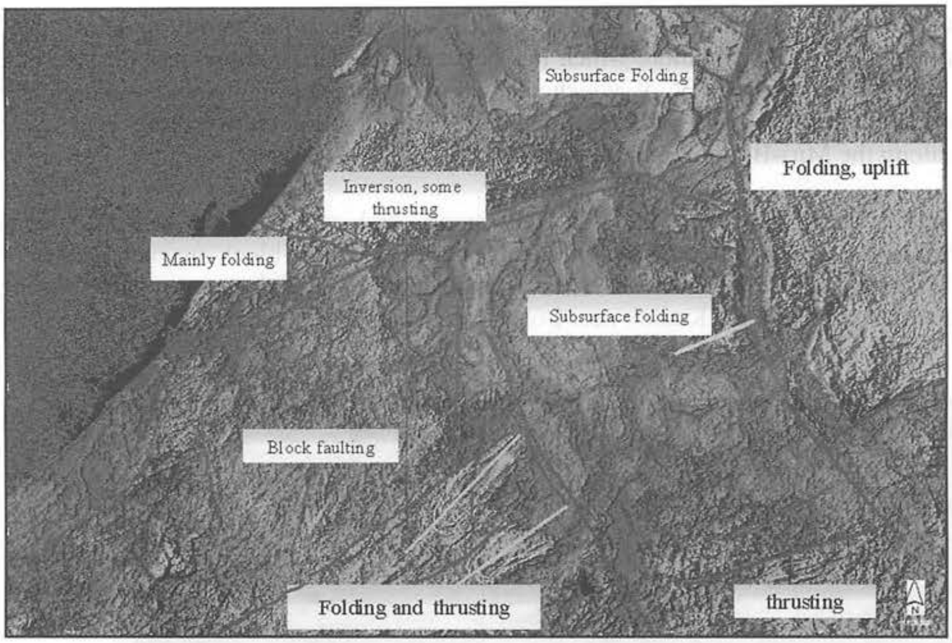


Figure 2: As the Sarawak foreland reacted to compression, it developed a mosaic of blocks. These blocks display distinct styles of deformation (also see Fig. 1): Luconia, Lambir, Baram Delta, Lapok, Belait and Limbang.

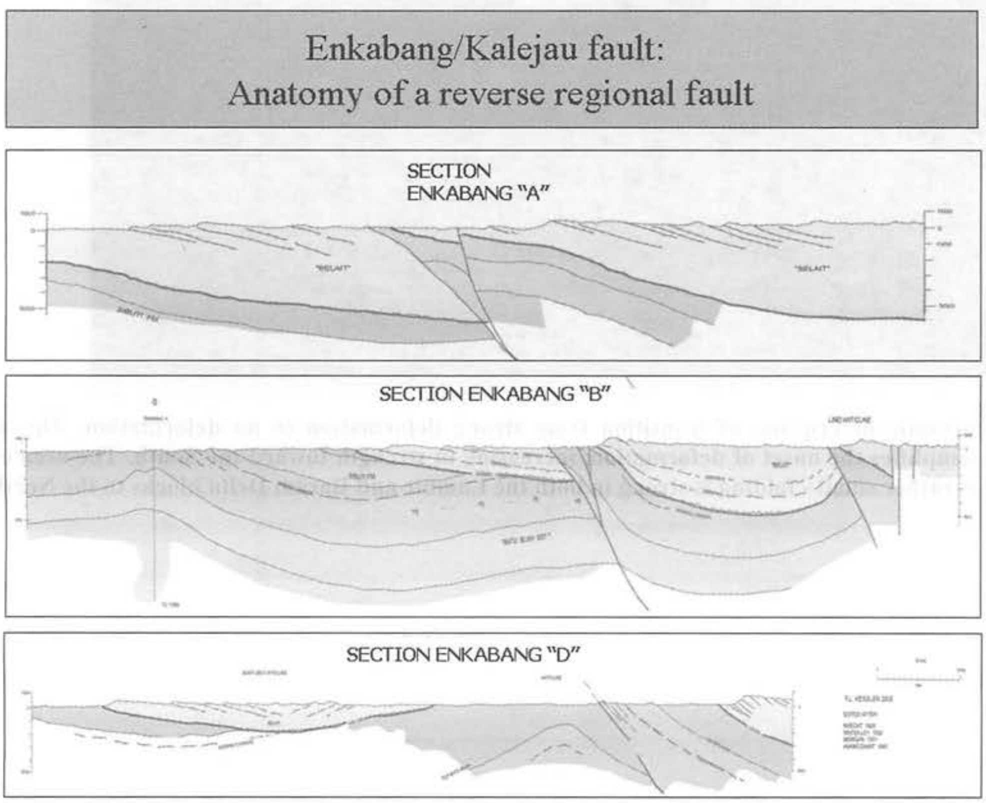


Figure 3: The Kalejau fault zone marks the boundary between the Belait syncline and the Baram block. It is one of the few areas, where E-W compression has played a significant role. As in other fault zones of Sarawak, most of the stress is accommodated in the immediate vicinity of the faults.

Emphasis in this paper is given to areas of moderate and weak deformation. The term 'transition zone' is applied to indicate an area of deformation, which lies between the main compressive thrust front, and a line called zero-deformation, NW of which all sediments are flat-lying and without any indications of deformation. This is shown in Figures 4 and 5. Figure 6 shows an overthrust exposed at the Lambir saddle, along the Miri-Bintulu road.

The areas of no deformation, however, are relatively small, and can be described as islands surrounded by deformation. Some onshore and offshore areas of the Luconia block are such islands of non-deformation. In several areas, we also observe an amalgamation of Palaeogene and Neogene tectonics, such as demonstrated in Batu Kadink near Long Lama (Fig. 7).

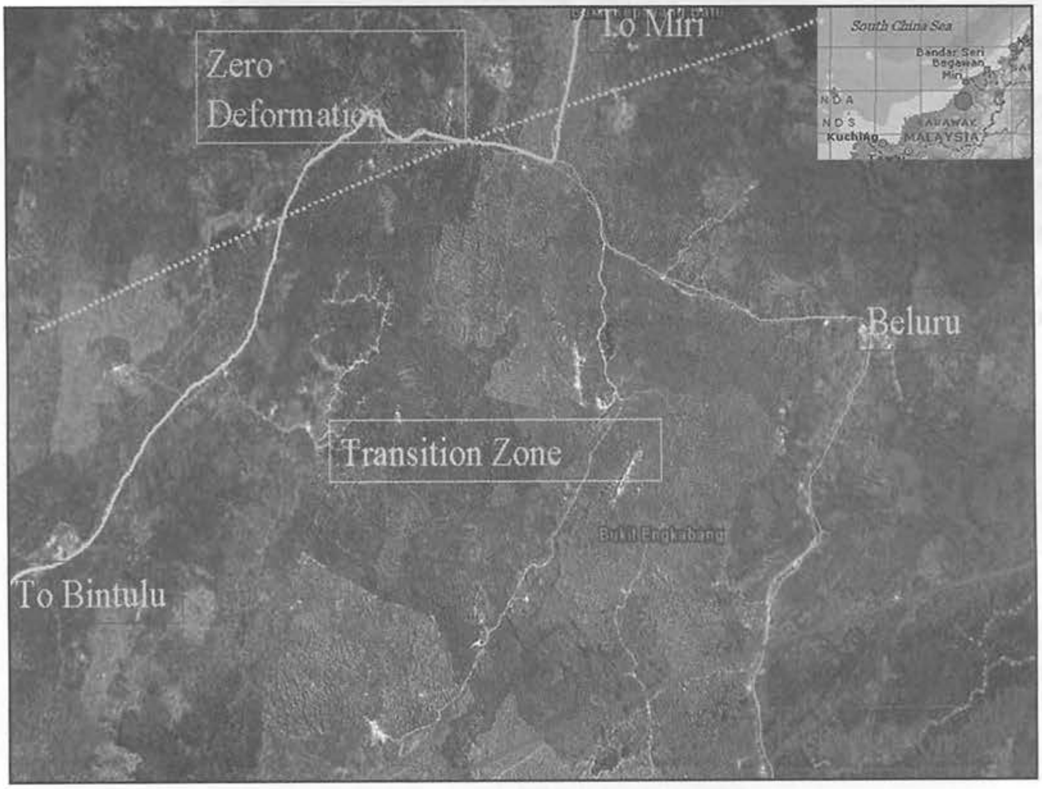


Figure 4: Schematic description of transition from strong deformation to no deformation. The blue-dotted line exemplifies the onset of deformation, increasing in strength toward the South. The area of no deformation is rather small - folding is strong in both the Lambir and Baram Delta blocks to the North.

Figure 5: Folded foreland near Beluru, with strike contours, faults, along the road (enhanced pink, centre of picture) to Lapok, and Long Lama. The dashed red lines are (poorly calibrated) faults.

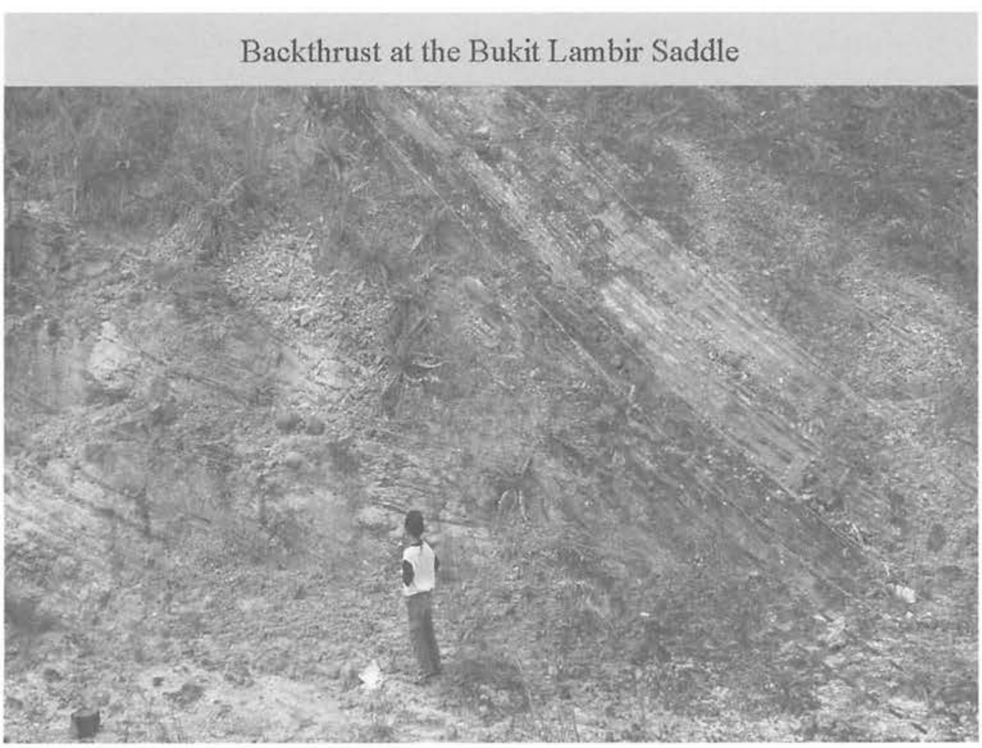


Figure 6: Minor thrusting as observed in Lambir along the Miri-Bintulu Road.

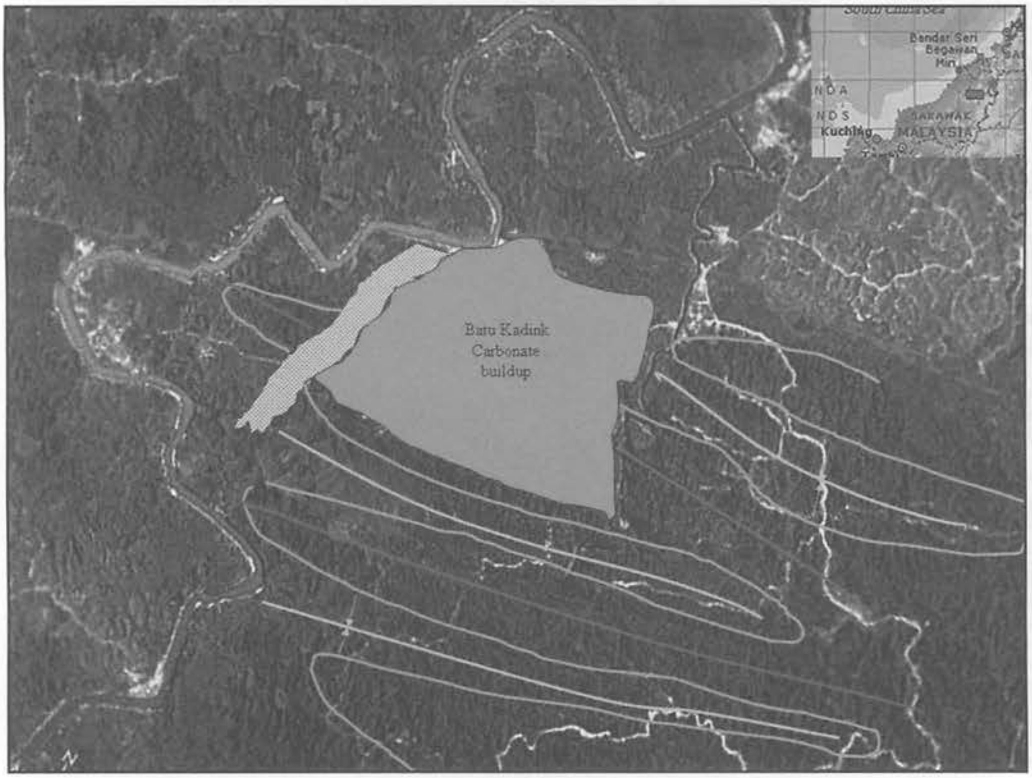


Figure 7: The Batu Kadink carbonate complex near Long Lama, at the Baram River. The carbonates overly a fold belt, of probably Palaeogene age. The overthrust front line toward the North, however, could be of a younger age.

Paper 2

Mass Transport Deposits of the Northwest Sabah Deepwater: Characterisation from seismic and borehole data

Sam Algar[1], Chris Milton[1], Paul Crevello[2], and Jon Roestenburg[3]

[1]Murphy Sabah Oil Company, Kuala Lumpur, Malaysia
[2] Petrex Asia Group
[3] Geotransformations Pty Ltd.

Abstract

Mass transport deposits (MTDs) make up a significant proportion of the sediments in the deepwater Sabah Trough off Northwest Borneo. Both modern and ancient MTDs have been recognised in seismic data and penetrated in numerous wells. This paper will discuss the characterisation of these MTDs and assess their relation to basin processes and reservoir deposition.

Preliminary seismic observations indicate that the MTDs vary in scale from units that are hundreds of metres wide and tens of metres thick to bodies that amalgamate to form areas in the hundreds of square kilometers with thicknesses in the hundreds of metres. Penetration of these deposits in wellbores in which image log data and conventional cores were taken has further constrained the make up of the MTDs and their relationship to reservoir sandstones. Both debritic facies and coherent slump facies are recognised within the MTDs. Work is underway to further constrain the genetic link that the MTDs appear to have with the hydrocarbon-bearing reservoirs in this prolific but relatively underexplored deepwater basin.

Paper 3

Impact of Tectonic Stress Variations on Field Development Planning in the Temana and Bayan Fields, Sarawak Basin

Stuart Smith[1], Isra Yendhi Ismail[1], Andrew Brehm[2], and David Castillo[3]

[1] PETRONAS Carigali Sdn Bhd, Kuala Lumpur, Malaysia
[2] GeoMechanics International Inc, Kuala Lumpur, Malaysia
[3] GeoMechanics International Inc, Perth, Australia

Properly planning a field development program encompasses many different disciplines and challenges. Important to addressing some of these challenges is the geomechanical model. Reservoir engineers and geoscientists are typically charged with the task of defining reservoir targets and geologic structures to minimize the risks, or at least understand the risks. However, often a geomechanical understanding of the reservoir and overburden is neglected. Incorporating a geomechanical model involves characterizing the *in-situ* stress magnitudes, stress orientations, pore pressure and rock strength. Ultimately, the purpose is to define drilling, completion, and production parameters to achieve the production target. When the geomechanical model is considered, one common mistake is to assume that the regional trends valid for one field apply to all other fields in the area. We present in here a case study where major stress variations were observed in the Temana and Bayan fields of the Sarawak Basin and how that has affected the development efforts.

Background

Both fields are located offshore in the Balingian structural province, WNW of Bintulu in Sarawak. Early exploration and appraisal wells in Bayan were drilled vertically, or near vertically, with minimal borehole instabilities observed during operations. Subsequently, highly deviated development wells experienced substantial drilling problems that were associated with wellbore instability. These excessive borehole breakouts resulted in annular pack-off and stuck pipe, which translated to Non-Productive Time (NPT) on the rig.

Initially it was believed the instabilities were a result of a drilling fluid interaction with shale, and that the formation was reactive (hydration of swelling mixed layer clays). Furthermore, in some of the wells no angular, platy or blocky cavings were observed after pack-offs; the material in the annulus was large blocks (10" or more) of clay. However, during the 2003 development drilling campaign, substantial laboratory testing of the shale in various inhibitive drilling fluids was carried out. The fluids being utilized in these wells were found to provide adequate chemical stability against swelling shale. Additionally, XRD/XRF analysis was carried out on formation samples. The results showed that the formation was not reactive but potentially dispersive (Fig. 1). The samples showed very little mixed layer clays to be present. The formation was found to comprise quartz as the dominant mineral held together in a weak matrix of kaolinite and feldspar.

Once chemical reactivity was ruled out as the root cause of borehore instabilities, other considerations needed to be made. It was noticed by PETRONAS Carigali Sdn. Bhd. (PCSB) that during the 2003 development campaign, most drilling problems tended to be well trajectory dependant. To further understand this observation, a detailed analysis of the regional stress state would need to be evaluated. GeoMechanics International, Inc. (GMI) was asked by PCSB to build a geomechanical model for the purpose of wellbore stability analysis near the end of the Bayan-D drilling campaign.

BAYAN 5				
XRD / XRF Mineralogy on less than 2 u size.				
Mineralogy, %	Shale above S1.9 sand at 4091 feet.	*Shale above S1.9 sand at 4102 feet.*	*Shale % S2.2 at 4141 feet.*	Shale above S2.2 at 4203 feet
% Clay	31.40	*38.5*	*39.9*	*36.2*
Illite	21	*39*	*27*	*33*
Kaolinite	79	*61*	*28*	67
Chlorite	0	*0*	*21*	*0*
Smectite	*0*	*0*	*0*	*0*
Illite / Smectite	0	*0*	*24*	*0*
Total	*100*	*100*	*100*	*100*

BAYAN 411		
XRD / XRF Bulk Mineralogy.		
Mineralogy, above	Cuttings sample during circulating at 9.5/8" shoe.	Depth: 3035 – 4050 feet
Smectite	*13*	*14*
Kaolinite	*15*	*15*
Illite	*10*	10
Calcite	*1*	*3*
Siderite	*2*	-
Halite	*5*	*2*
Pyrite	*1*	*1*
Feldspar	*15*	*5*
Quartz	*38*	*50*
Total clay minerals	*38*	*39*
Cation Exchange Capacity, meq/100 gr.	*10*	*11*

Figure 1. This table illustrates the mineralogy found in the Bayan field. This information was used to determine if the mechanism of wellbore failure was chemical or mechanical in nature.

The study proved to be extremely valuable to the drilling of the remaining infill wells. Once the geomechanical model was built and utilized, the remaining wells were drilled with minimal borehole instabilities resulting in a marked reduction in NPT. Furthermore, PCSB was now able to look forward to the rest of the development plan and consider applications outside of the drilling operations.

Temana is a field approximately 50 km SE of Bayan. Prior to the study GMI performed on Bayan, a third party performed a geomechanical analysis on Temana that predicted the stress direction nearly the same as seen in Bayan and other regional fields, but the stress magnitudes were different. Furthermore, it did not utilize the available image data for breakout analysis to determine stress direction and magnitude. Given the history of the Bayan development, PCSB took a proactive approach to Temana and engaged GMI in a second geomechanical analysis prior to the development drilling campaign. It was originally thought this second study would bring clarity to the contradicting stress magnitudes while the stress direction would remain consistent with the regional trends. This, however, was not the case; subsequent geomechanical modeling of the Temana field found that the stress magnitude to be similar to Bayan, yet the stress direction was very different. This has had a significant impact on both the drilling and completion planning for the field. To date, the revised geomechanical model has nearly eliminated all NPT associated with wellbore instabilities in the Temana development campaign.

Geomechanical Modeling

A geomechanical model consists of four principal components; the in-situ stress magnitudes, the relative stress direction, formation pressure, and the effective rock strength of the formations. Bulk density logs and leakoff tests provide direct measurements of the vertical stress magnitude (S_v) and the minimal horizontal stress magnitude (S_{hmin}), respectively. Image logs and oriented multi-arm caliper logs provide direct measurement of stress direction. The data types used to quantify the parameters of a geomechanical model are listed in Figure 2. Unfortunately, reliable direct measurements of the magnitude of the maximum horizontal stress (S_{Hmax}) do not exist, although, indirect observations such as wellbore failure features can be used to quantify absolute S_{Hmax} stress magnitudes. This indirect approach of quantifying and later verifying S_{Hmax} stress magnitudes is an important step because it is one of the most important parameters of the geomechanical model. Properly identifying the absolute magnitude of S_{Hmax} is critical to understanding how to optimize a field development.

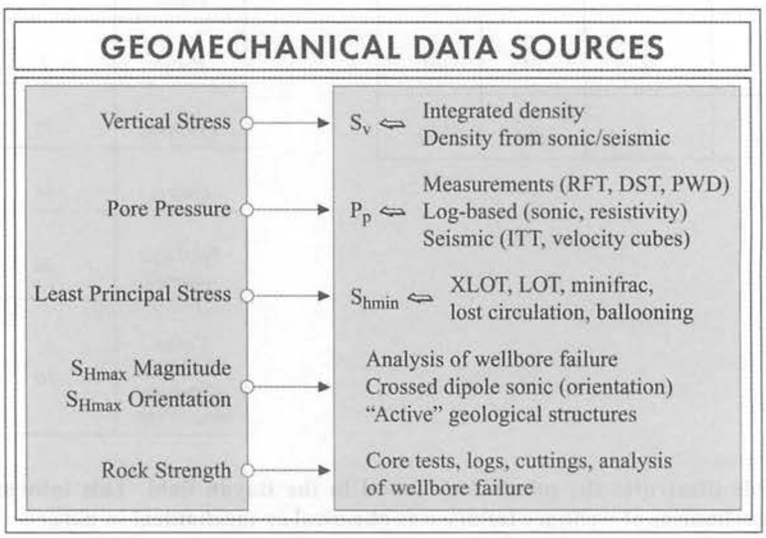


Figure 2. This table illustrates some of the input data used to create a geomechanical model.

In many cases around the world, it is common to find a consistent regional stress direction that is similar in multiple adjacent fields. Interestingly, previous to the Temana study, GMI observed a relatively consistent stress direction in the Sarawak Basin. Fields such as the Bayan field had been analyzed using image and multi-arm caliper data which revealed a consistent S_{Hmax} direction of approximately N10°E. Because wellbore failure was observed and the image data allowed for accurate measurement of the failure, the stress models created from this data were well constrained. In contrast, observations of borehole failures from image logs collected in the Temana field also indicated a well constrained model, but the resulting S_{Hmax} stress direction was nearly 90° different than the regional trend.

Figure 3 shows the general concept around how wellbore breakouts form. By removing rock and replacing it with drilling fluid, different parts of the wellbore wall may be subjected to both tensional and compressional stresses. If the effective stress is higher than the rock strength, then a wellbore breakout will form. The effective stress on the wellbore wall caused by these regional stresses can be reduced by raising the mud weight, but raising it too high may create tensile fractures. Figure 4a is an image log from a Bayan well showing occurrences of wellbore breakouts. Each of these breakouts is 180° apart and has a breakout width of ~30 - 60°. Referring back to Figure 2, breakouts occur in the direction of S_{hmin} for vertical wells (which this is), so therefore the azimuth of S_{Hmax} in this well would be nearly N-S. Similar results were concluded from all the wells in Bayan. Figure 4b is an image log from Temana showing occurrences of wellbore breakouts. Again, we see breakouts with the approximate width of 30 - 60°, however, the azimuth of the breakouts in Temana is about N-S (also a vertical well), implying the S_{Hmax} direction is about E-W. This also was observed in multiple Temana wells. Figure 5 is a S_{Hmax} stress map of the Temana and Bayan fields. The geologic explanation for the change in S_{Hmax} direction is not clear at this time. Structure and active faulting can have a large impact on stress directions in a basin. Further investigations in other fields are needed to better understand why these differences in S_{Hmax} stress directions are seen in the Sarawak Basin.

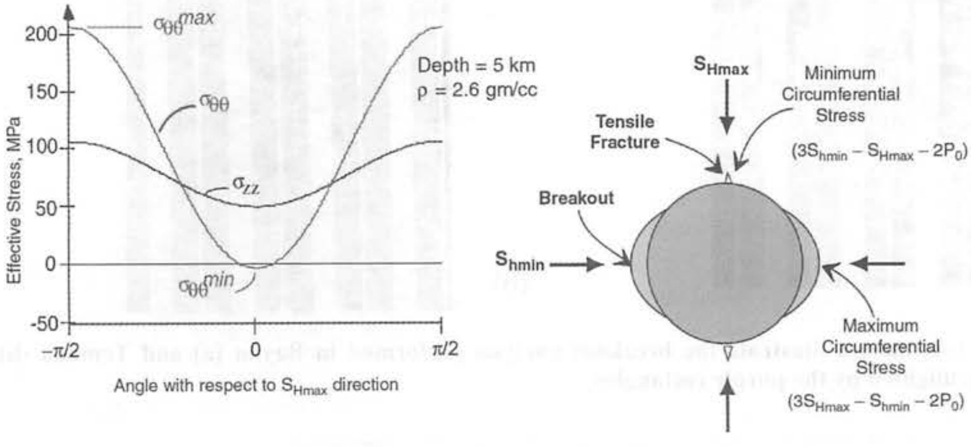


Figure 3. This figure illustrates the general concept of how borehole breakouts form. Based on the regional stress magnitudes, parts on the wellbore wall are put in tension and other parts in compression. When the stress is high enough, the rock will fail forming what is called breakouts.

In addition to the stress direction, the observation of these breakouts in both fields also allowed for good quantification of the S_{Hmax} magnitude. Unlike the differences in S_{Hmax} stress direction, the absolute S_{Hmax} magnitudes indicated very similar magnitudes in both fields. Both fields appear to be in a Strike-Slip faulting regime which implies S_{Hmax} is the greatest stress while S_{hmin} is the least, while the S_v is the intermediate magnitude (i.e., $S_{Hmax}>S_v>S_{hmin}$).

To verify both models, the wellbore failure experienced in each of the study wells needed to match what the geomechanical model was predicting, taking into consideration how each of the study wells were drilled. Successfully matching the wellbore observations would provide confidence that the geomechanical model could then be used in a predictive sense to forward model wellbore stability applications and further constrain completion strategies for the field development plan. Figure 6 shows an example of the calibration work done on the Temana project suggesting that the model provides a reliable representation of the operating stresses in the field area. Similar work was done for all offset wells in the Bayan field.

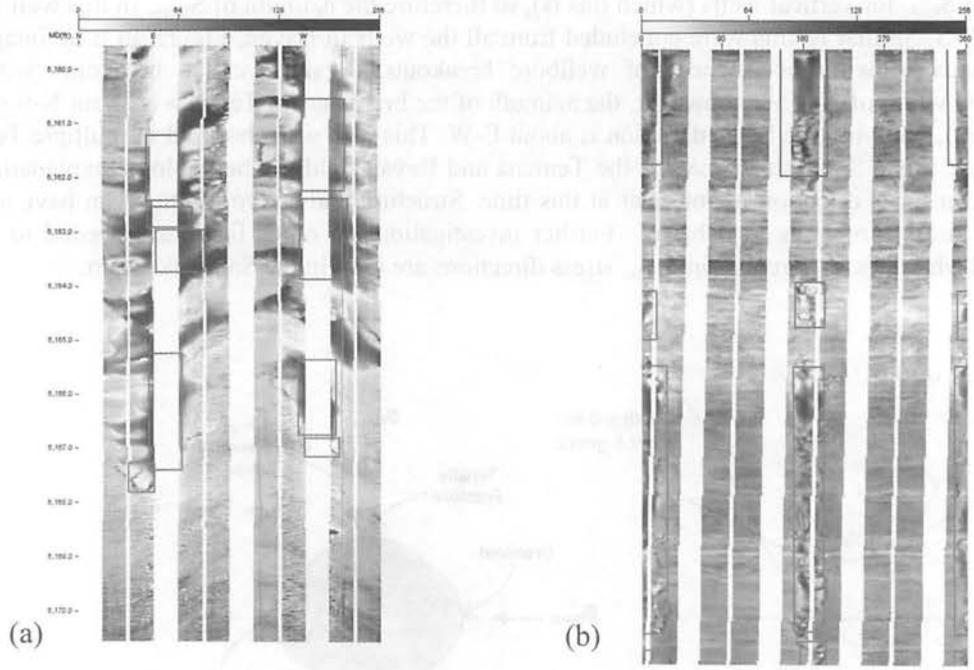


Figure 4. These two images illustrate the breakout analysis performed in Bayan (a) and Temana (b). Breakouts are highlighted by the purple rectangles.

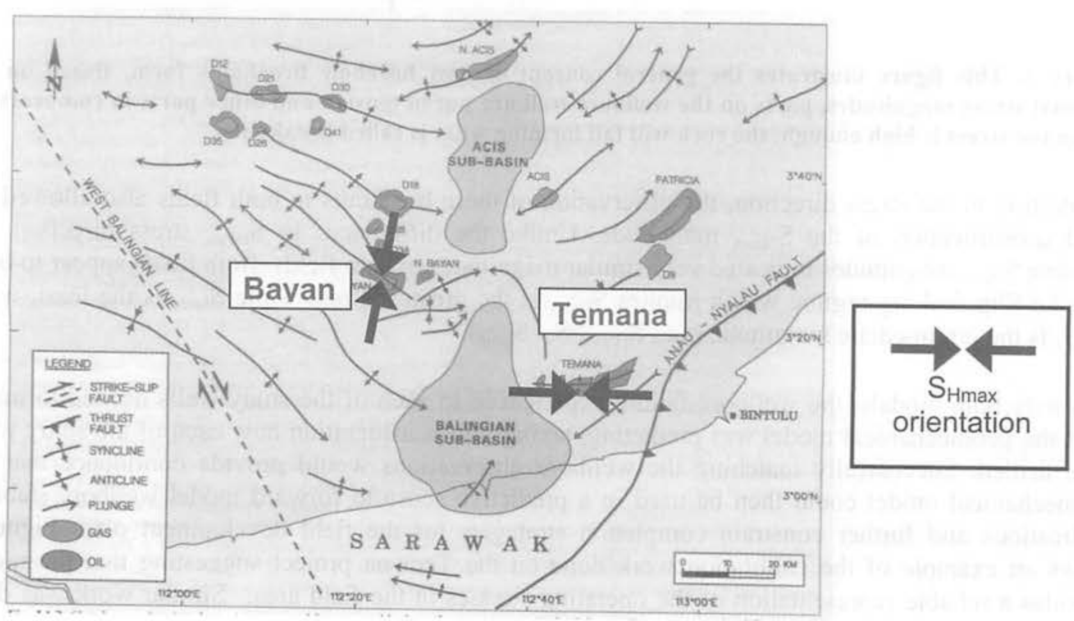


Figure 5. Map showing the relative closeness of these two fields. Often fields in such close proximity are assumed to have the same stress field.

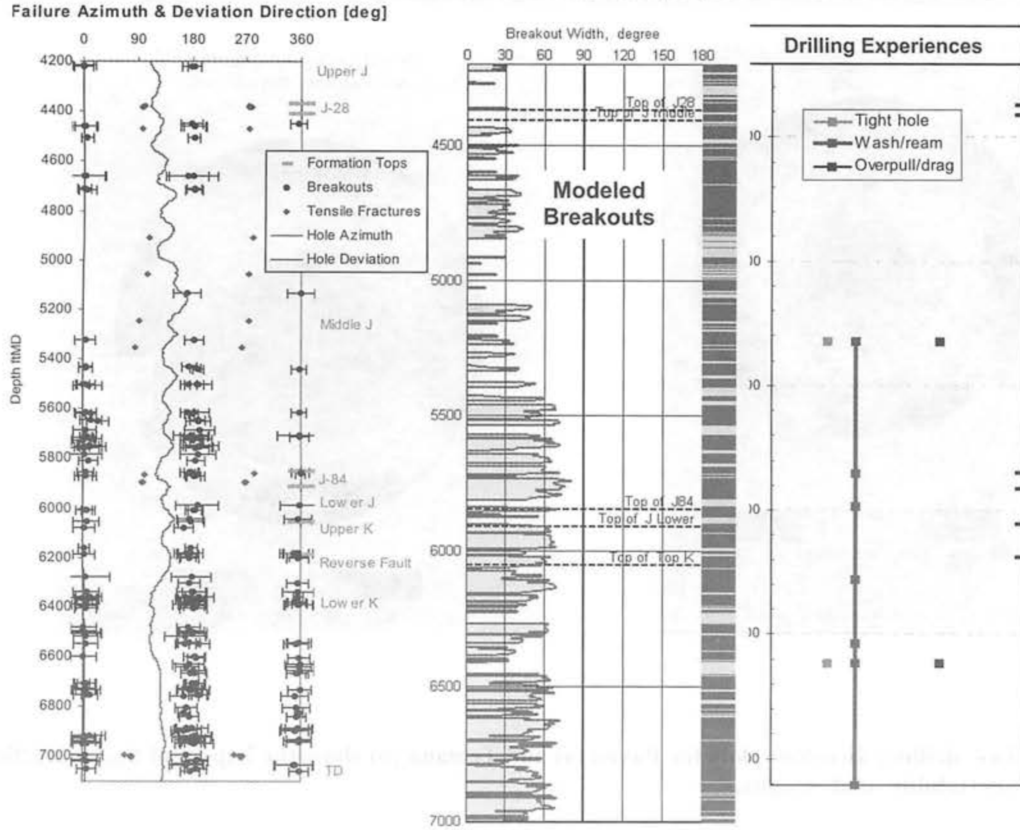
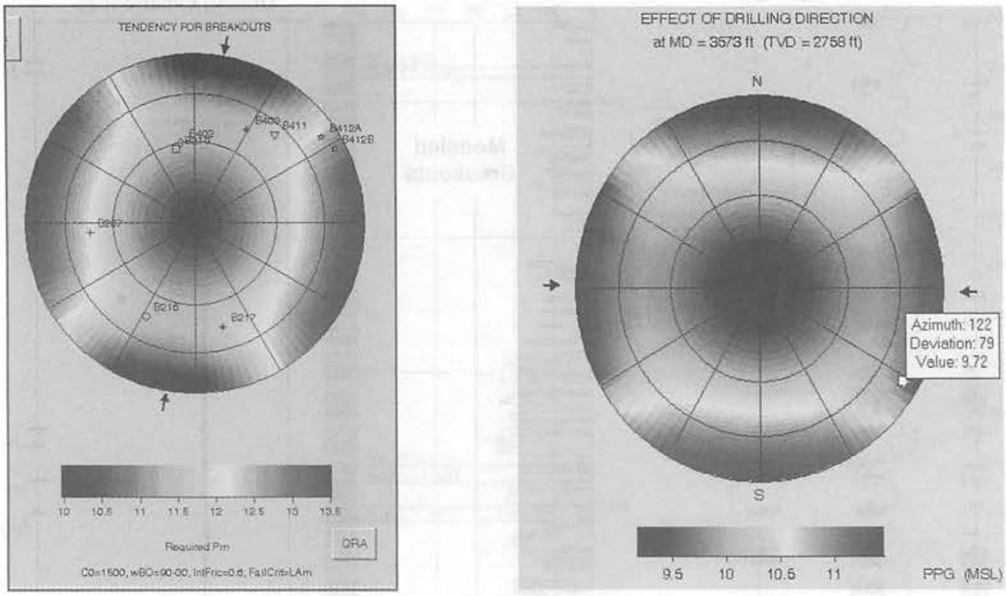


Figure 6. This illustration shows the calibration work that is done to make sure the predicted breakouts using the geomechanical model match the observed breakouts in the offset wellbores. This particular example is from the Temana study.

Applications to Development Planning

A large number of oil and gas field applications use geomechanical models to positively impact field development. It starts with applications to fault trap capacity and can be part of the development plan that includes analyzing field compaction and subsidence following some degree of depletion. In the case of Bayan and Temana, the primary application of the geomechanical model was for the drilling operations. However, the results have also proven useful for the completion and production aspects of the developments.

In each of these developments, the pressing issue for the asset teams was to avoid wellbore instabilities. Non-productive drilling time associated with wellbore failure is what prompted the geomechanical analysis on Bayan and this was also the motivation for initiating the geomechanical study on Temana prior to the start of development drilling. In each of these studies, the drilling operations were optimized by identifying mud weights needed to minimize wellbore instabilities, determining casing points by considering stability mud weights as well as mud weights needed to avoid the creation of hydraulic fractures, and determined the best drilling directions in terms of minimal casing strings needed and lower stability mud weights needed. For each of these deliverables, the stress magnitudes and directions have a significant impact on the results. Strike-Slip faulting regimes usually mean there will be a strong directional preference for drilling mud weights, so the variation in stress direction became very important for the Temana development. Figure 7 shows drilling direction plots from Bayan and Temana. Clearly, the S_{Hmax} stress direction can impact the mud weights needed to maintain wellbore stability. Interestingly, had the Temana wells been drilled with the assumption that the stress direction is the same as Bayan, severe wellbore stability problems could have occurred.



(a) (b)

Figure 7. These drilling direction plots for Bayan (a) and Temana (b) show the impact of S_{Hmax} direction on the drilling stability mud weights.

In addition to the drilling aspects of the development plan, the geomechanical model is now being used to evaluate the completion and development aspects in each of these fields. The geomechanical model can allow optimization of your completion strategy by helping to understand when the onset of solids (or sand in this case) will be seen. This is evaluated by considering the geomechanical model, the rock mechanical properties, the well trajectory, the completion type (i.e., open hole vs. cased hole). For the cased hole case, perforation orientation and selective perforation becomes critical to the completion strategy. This information is then used to determine the maximum sand free drawdown rates and depletion. Furthermore, as the depletion grows over time, the stress magnitudes also change. Understanding how these affect the relative stress field can provide insight into the reactivation of faults and changing of production rates down the road.

Conclusions

Introducing the geomechanical model into the development plans of Bayan and Temana has brought considerable value to PCSB. Most of the realized value to this point has come in the way of optimizing the drilling performance and well design, but the geomechanical model has provided, and will continue to provide, insight into the development of these fields. These studies have also shown quite clearly the importance of building a geomechanical model for each field drilled. While regional trends can be useful when no other data is available, it is not the best solution to properly optimizing a full field development.

Acknowledgments

We would like to thank PETRONAS Carigali Sdn. Bhd. and GeoMechanics International, Inc. for allowing us to present this material. We would also like to thank all of our colleagues who participated in these projects and helped to create a success story.

Paper 4

Seismically Driven Fractured Reservoir Characterization

Abdel M. Zellou, Ahmed Ouenes, Gary Robinson and Udo Araktingi

Prism Seismic, Centennial, CO, USA

Introduction

Efficient development of fractured reservoirs has been notoriously difficult. This inefficiency arises from the difficulty in locating the fractures in the reservoir. By synergistically combining seismic data, containing the interwell information, with geologic and engineering data at the wells, we develop a fracture model that honors the various datasets and successfully predicts the location of fractures within the reservoir. This method has been successfully applied to a complex fractured reservoir.

Fracture Modelling Techniques

The discrete fracture network (DFN) approach uses fracture information in wells to statistically distribute fracture planes in the reservoir. Unfortunately after years of application, the resulting fracture permeability from the DFN approach is still unable to match individual well performances since it relies heavily on calibration (Casciano *et al.* 2004) in the near-wellbore area and does not address efficiently the interwell region.

Geomechanical models (Mace, Souche & Mallet, 2004) attempt to define the stress-strain field that generated the fractures, and thereby predict their location. Even if one can accurately model the stress-strain field that generated the fractures, other factors not incorporated into the model, such as lithology and diagenesis, also affect the location of open fractures.

The continuous fracture modelling (CFM) approach attempts to define the geologic factors, or "drivers", that determine the fracture intensity within the reservoir. This approach incorporates many attributes, derived from seismic, geologic, and engineering data, in creating an integrated fracture model (Ouenes, 2000; Zellou & Ouenes 2001). Unlike the previous two methods, the CFM approach can integrate many seismic attributes, either post-stack or pre-stack, in the modeling process (Ouenes *et al.,* 2004; Wong & Boerner, 2004).

Application to a Fractured Reservoir

Many oil and gas fields lie within fractured and weathered zones of crystalline, mostly metamorphic, basements (Kiss & Tóth, 1985). These reservoirs are characterized by a complex lithology that includes phyllites, schists and slates. The porosity of these reservoirs is usually very low, in the range of 2-8%, and exhibits a very heterogeneous distribution. The fracture distribution is also very heterogeneous, with no apparent controlling geologic factor. Various fracture modeling approaches, including DFN, have been previously applied on such reservoirs. Without seismic attributes to assist in the modeling, the prediction of fracture density and petrophysical properties in the reservoir is quite difficult.

The studied field has 13 wells located within a 25 square kilometer area covered by a 3D seismic survey. As the 3D survey was not designed to provide the wide azimuth distribution necessary to generate pre-stack azimuthal attributes, only post-stack seismic attributes were generated for use in fractured reservoir characterization.

Using 5 of the 13 wells, a high-resolution seismic impedance volume with a sample rate of 0.5 ms was generated. The resulting impedance was compared to the actual impedance at 4 blind wells (Fig. 1). The correlation coefficient between the actual and predicted impedance at the 4 blind wells is 0.76, indicating the ability of the high resolution inversion to accurately predict the impedance in the 3D seismic volume.

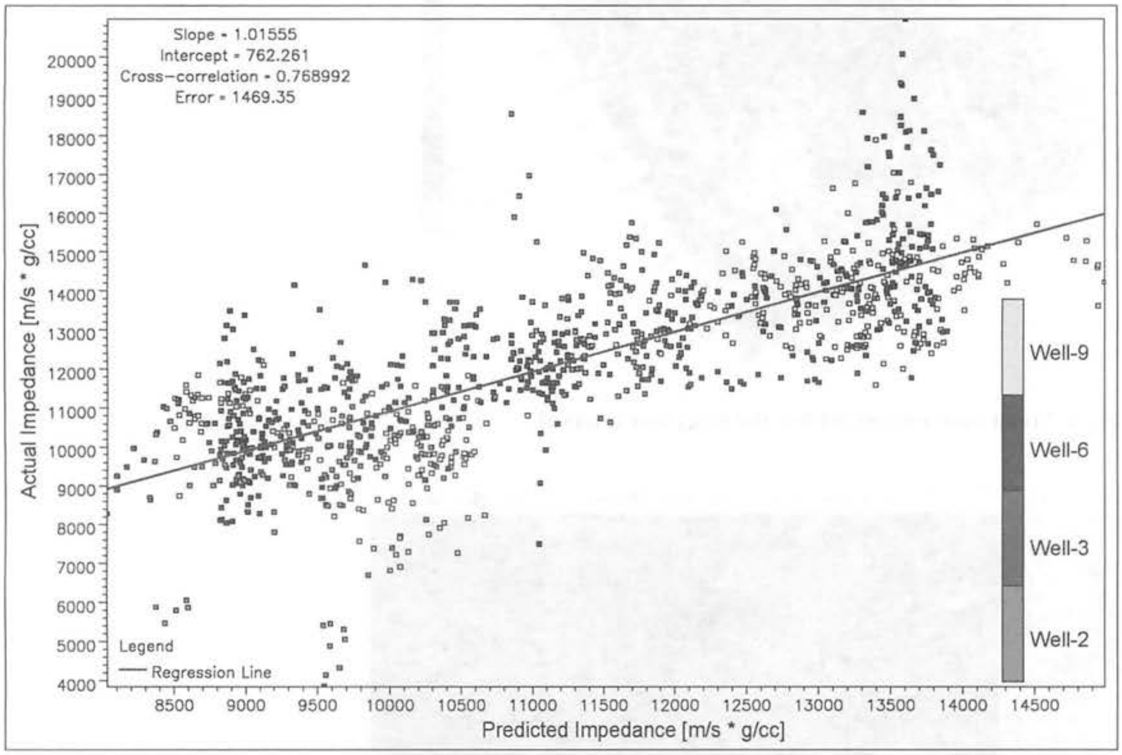


Figure 1. Predicted (x-axis) versus actual (y-axis) impedance.

Spectral imaging was also applied to the 3D seismic volume. Various frequency-dependent and composite attributes were computed from the spectral imaging results. Figure 2 displays the mean total energy, one of the composite spectral attributes, in the reservoir interval. Trends observed on the mean total energy slice correlate with fault trends in the reservoir. Using the inverted impedance and three spectral imaging attributes, geologic models of gamma ray, resistivity, and porosity were generated. In addition to the attributes described above, nine geomechanical attributes, mainly curvatures and slopes in various directions, were computed for use in the fracture modeling.

The fracture modeling incorporated 16 drivers: 4 seismic drivers, 3 geologic drivers, and 9 geomechanical drivers. Using the available fracture density computed from the CBIL logs at three wells as an output and the 16 drivers as inputs, 3D fracture models were estimated in REFRACT, a neural-network-based CFM modeling software. An average 3D fracture model was derived from 10 stochastic models and was combined with well test data at two wells to generate a fracture permeability model for simulation. Figure 3 shows a cross-section of the fracture density passing through the three wells used for the fracture modeling. It is important to notice the vertical and lateral heterogeneities captured by the post-stack seismic attributes.

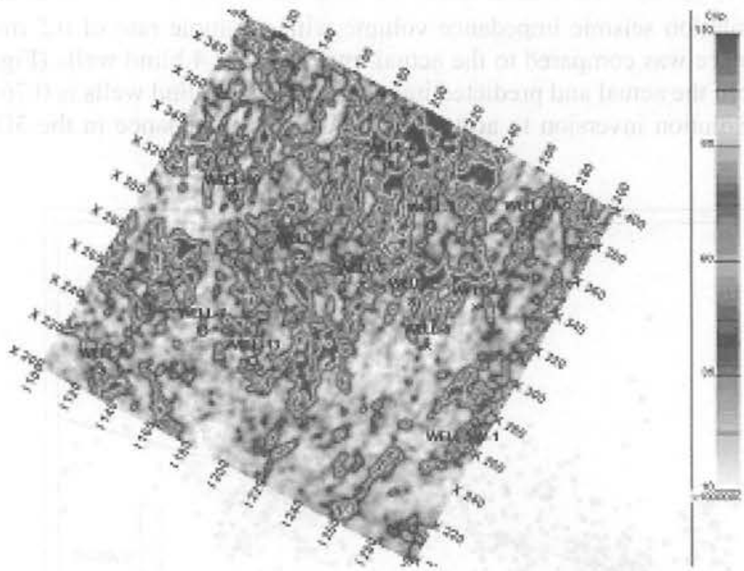


Figure 2. Mean total energy within the reservoir interval.

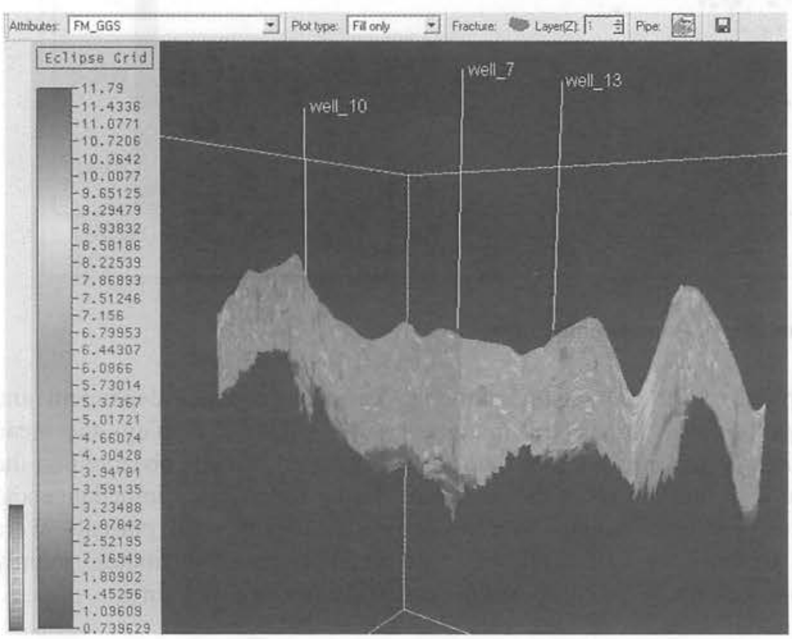


Figure 3. Facture density across the reservoir.

Model Validation at Blind Wells

The fracture density at two blind wells was extracted from the average 3D fracture model estimated in REFRACT. Figure 4 shows that the CFM approach was able to capture the vertical and areal trend of the fractures. In a relative sense both the high and low fractured zones were predicted which is an important requirement for creating reliable fracture permeability models. These fracture permeability models are derived in REFRACT by using as input the derived fracture intensity along with well test data.

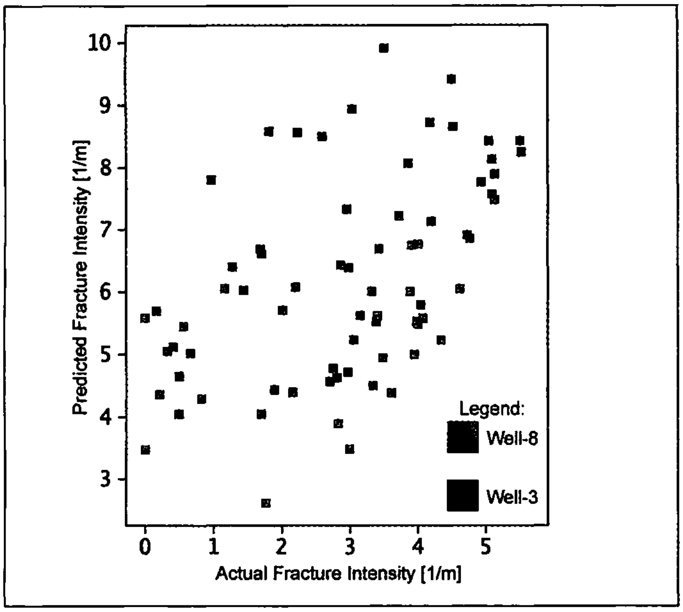


Figure 4. Comparison of actual and predicted fracture density at 2 blind wells.

Conclusions

The reservoir studied here is complex, with a heterogeneous distribution of porosity and fractures. The use of the CFM approach for fracture modeling provides the ability to integrate multiple seismic attributes, along with geologic and engineering data from the wells – a feature not found in other fracture modeling techniques. The use of seismic attributes derived from high resolution inversion and spectral imaging in the CFM approach provided the information necessary in the interwell region. As a result, the fracture density in the reservoir can be accurately predicted in the entire 3D volume

References

Casciano, C., Ruvo, L, Volpi ,B., and Masserano F. (2004): Well test simulation through Discrete Fracture Network Modelling in a fractured carbonate reservoir. Petroleum Geoscience 10, 1-12.

Kiss, B. and Tóth, J. (1985): Well Log Interpretation of Metamorphic Hydrocarbon-Bearing Formations. First Break, 3 (5), 24-31.

Mace, L., Souche, L, and Mallet, J. (2004): 3D Fracture Characterization Based on Geomechanics and Geologic Data Uncertainties. ECMOR IX, Cannes, France

Ouenes, A. (2000): Practical application of fuzzy logic and neural networks to fractured reservoir characterization. Computers and Geosciences, 26 (7)

Ouenes, A., Zellou, M., Robinson, G, Balogh, D. and Araktingi, U. (2004): Improved Reservoir Simulation with Seismically Derived Fracture Models, SPE 90822

Wong, P. and Boerner, S. (2004): Quantifying Uncertainty for mapping fracture intensity: an improved workflow. First Break, 22, 41-47.

Zellou, A. and Ouenes, A. (2001): Integrated Fractured Reservoir Characterization Using Neural Networks and Fuzzy Logic: Three case studies. Soft Computing and Intelligent Data Analysis in Oil Exploration, (Developments in Petroleum Science Series), V 51. Elsevier, Amsterdam

Paper 5

AVO Analysis for Direct Hydrocarbon Detection in field X in the Persian Gulf

Dr.Mohammad Ali Riahi and Mohammad Emami Niri

Department of Geophysics, Tehran University

Abstract

A seismic line and two wells from an oil field in the Persian Gulf were selected to present the results obtained from an AVO analysis for detection of hydrocarbon reservoir.

A special AVO processing was applied to data using Vista package software. To obtain broadband data and suppression of noise and multiples, deconvolution and radon transform were performed.

In AVO interpretation an amplitude anomaly in AVO attributes was detected. Then a CDP Gather was checked for our hypothesis. In the next stage, an iterative and linearzed inversion algorithm carried out in the x-t domain was applied to a CDP gather. Then well logs were used to generate the initial starting model for the inversion. The inversion, performed with starting model in pay zones having a Poisson's ratio appropriate with hydrocarbon saturation in the target zone, there is convergence from the initial to the real seismic gather.

At the last stage, the P-wave velocity map of section was computed by finding a multi-linear relationship between sonic logs and attributes. Then this relationship was applied to the attributes. In the P-wave velocity computed section, a low velocity anomaly was found that matched with AVO anomaly in other attributes, proving that the observed AVO anomaly is gas cap of the field.

Introduction

Contrasts in the elastic parameters of subsurface layers often cause distinguishable amplitude phenomena on surface seismic data. Various techniques are used to analyse and highlight such phenomena for their potential use as "Direct Hydrocarbon Indicator (DHI)". For many years, it has been a common practice to use Bright Spots, Flat Spots and Dim Spots in seismic data interpretation, using complex trace analysis introduced by Taner *et al.* (1979), as visual signatures for these DHIs. More recently, other techniques have been developed based on the variation of reflection coefficient with angle of incident, conventionally called Amplitude-versus-Offset (AVO).

Relating rock elastic properties to seismic reflections starts with the elastic wave equations given by Knott-Zeoppritz (1919). The equation relates the reflection coefficient of an interface to the change in velocities of P and S waves and density of the formations above and below it and the angle of incidence of the seismic ray path.

An exact solution of the Zeoppritz equations is not readily amenable for inversion of seismic field data because of the many variables involved. Most of these variables are, in practice, unknown and difficult to be guessed for the rock formation under investigation, e.g. a hydrocarbon reservoir. Therefore, a form of approximation is often employed to make the problem tractable.

Case Study

Field X is located in the NE of Persian Gulf and East of Khark Island. The producing formation of this field is Ghar-Sandstone which is the target zone for this study.

The data for this study consist of a land line shot with explosive source and with 240 receivers arranged in a split-spread configuration. The acquisition parameters for these data were: shot-station spacing, 25 m; receiver-station spacing, 12.5 m; near offset, 135 m; far offset, 3122.5 m; and sample rate of data is 3 s.

Processing of seismic data for AVO analysis

The objective of processing in AVO analysis is to reveal the relative amplitude, though not necessarily the true absolute amplitude of primary reflection. To quote Ostrander (1984), "Because one has great difficulty in separating out 'true' reflection amplitudes, the interpreter typically must rely on relative changes, concentrating on anomalous behavior of the amplitude." A similar philosophy is adopted here. The designed processing sequences for this study (Fig. 1) removes many, but not all undesired influences and amplitude anomalies are effectively highlighted.

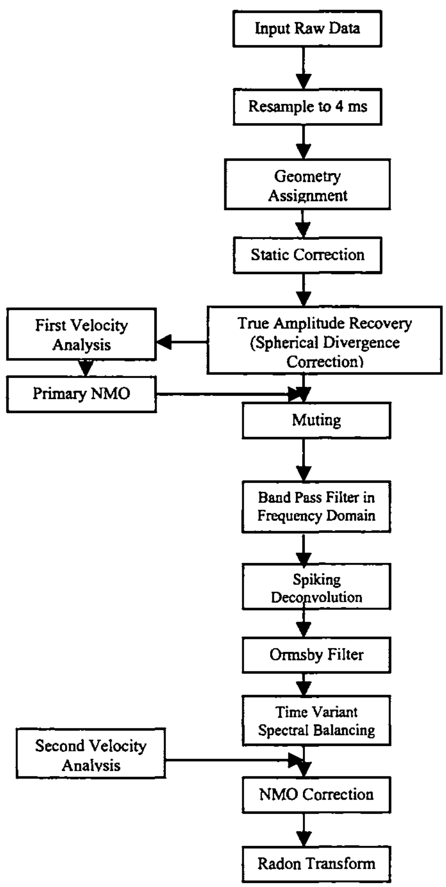
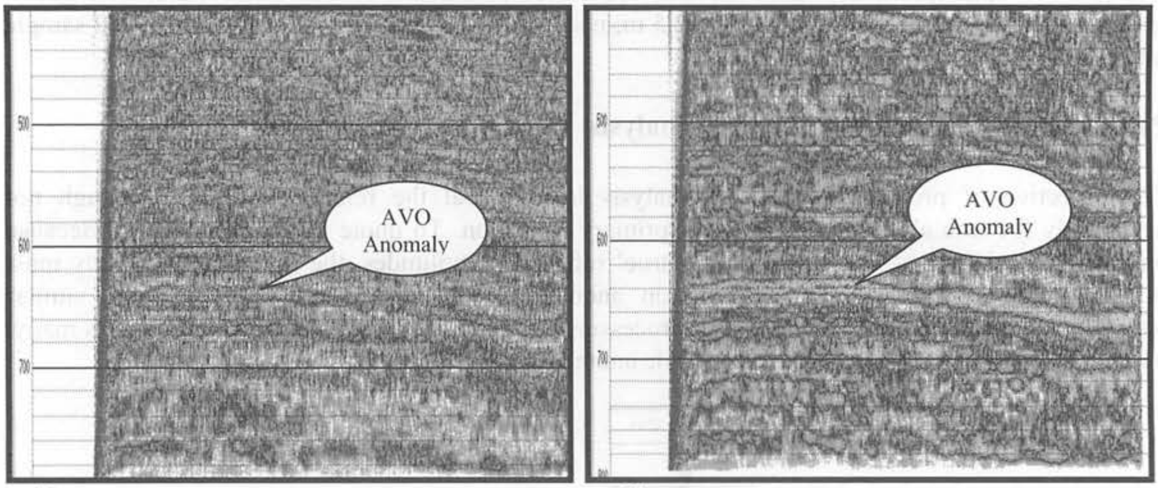


Figure 1. Processing sequence used to process the seismic data in this study.

Quantitative AVO Analysis

After preparing the seismic data, the linear regression analysis is applied to real data to determine the P-wave reflection coefficient (R_P) and Gradient (G) attributes for the seismic events of interest on each NMO-corrected CMP gather across the data set. Plotting of these attributes reveal an AVO anomaly at about 635 ms TWT, which is clearer in gradient section (Fig. 2).

After preparing the seismic data, the linear regression analysis is applied to real data to determine the P-wave reflection coefficient (R_P) and Gradient (G) attributes for the seismic events of interest on each NMO-corrected CMP gather across the data set. Plotting of these attributes reveal an AVO anomaly at about 635 ms TWT, which is clearer in gradient section (Fig. 2).

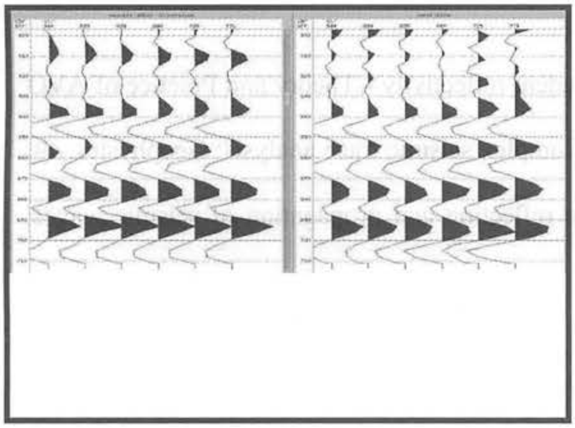


(a) (b)

Figure 2. Display of (a) P-wave reflection coefficient attribute and (b) Gradient attribute; Amplitude anomaly at 635 ms is shown in both sections but is clearer in gradient display.

Modeling and Inversion

The objective of modeling is to seismically simulate the response of the target zone in the well. The result will be a CMP gather of synthetic seismic traces generated at different receiver locations with increasing offset. In this study we used Zeoppritz equation and Ray-Tracing method for modeling. We had P-wave logs, Density logs and create S-wave logs with Castagna and Buckus' equation (1993). After extracting a wavelet with good correlation coefficient for creating synthetic seismogram and using Biot-Gassmann equation for FRM (Fluid Replacement Modeling) in target zone, we achieve final synthetic seismogram. Then linearzed inversion algorithm carried out in the x-t domain was applied to a CDP gather.



(a) (b)

Figure 3. (a) AVO inverted data, (b) real data, within target zone. There is convergence from initial to the real seismic gather.

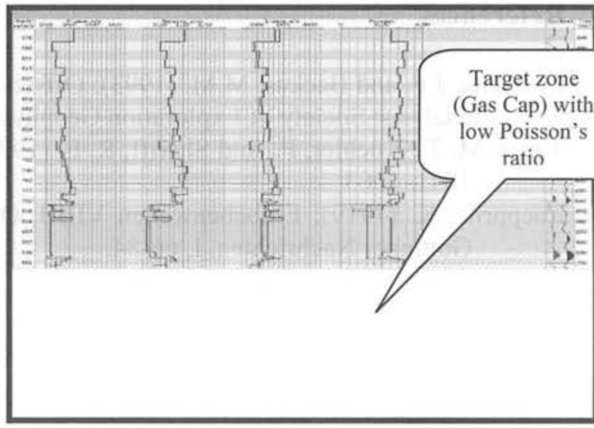


Figure 4. Processed and inverted well logs. Notice in the target zone, there are three parts the with different Poisson ratio, maybe indicating gas, oil and water.

P-wave velocity section

The P-wave velocity section was computed by finding a multi-linear relationship between sonic logs and attributes. Then this relationship was applied to the attributes. In the P-wave velocity computed section, a low velocity anomaly (-1900 m/s), that matched with AVO anomaly in other attributes, occurs at 635 ms coinciding with the gas cap of the field (Fig. 5).

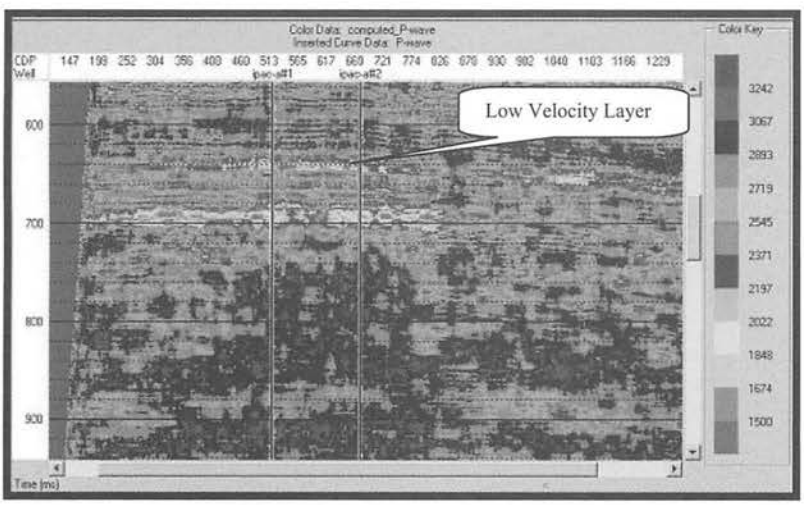


Figure 5. Computed P-wave velocity section. A low velocity anomaly is seen at 635 ms.

Conclusions

- Plotting P-wave reflection coefficient (R_P) and Gradient (G) attributes reveals an AVO anomaly at about 635 ms TWT, which is clearer in gradient section.
- There is convergence from the initial to the real seismic gather.
- On the inverted well logs within the target zone, there are three parts with Poisson's ratio of 0.1, 0.2 and 0.3, probably indicating gas, oil and water.
- In the P-wave velocity computed section, there is a low velocity anomaly (-1900 m/s), that matched with AVO anomaly in other attributes.

- These proved that the observed AVO anomaly is the gas cap of the field.

References

Castagna, J.P. and Backus, M.M. (1993): Offset-dependent reflectivity - Theory and Practice of AVO analysis: Society of Exploration Geophysics.

Taner, M. T., Koehler, F., and Sheriff, R. E. (1979): Complex seismic trace analysis: Geophysics, 44, 1041–1063

Zoeppritz, K. (1919): Erdbebenwellen VIIIB, On the reflection and propagation of seismic waves, Gottinger Nachrichten, I, 66-84.

Paper 6

Shale Chaser - A Seismic Inversion method to determine the presence of shale barriers for reserves computation considerations.

Vincent W.T. Kong[1] and Jimmy C.S. Ting[2]

[1] Petronas Carigali Sdn. Bhd.
[2]Fugro-Jason (M) Sdn. Bhd.

The audited volumetric calculations associated with the field in question were based on two scenarios; a one-pressure system, and a two-pressure system having a difference of about 0.4 TSCF between either scenario.

The tank scenario depends on the critical lateral continuity of an intra-formational shale baffle which, if present everywhere within the field, separates it into the lower volume two-pressure system, otherwise it would be a one-pressure system.

The field is covered by 3D seismic data, with near and far angle sub-stacks available. The normal full-stack seismic data, in the form of either the reflectivity or the compressional (P) acoustic impedance were unable to separate the sands and shales at the target depth because of the overlapping acoustic properties of these lithologies at this particular zone of interest. Hence, the AVO Inversion approach was required, making use of multiple computed rock properties attributes to capture the desired lithology by means of cross-plot isolation.

The angle sub-stacks were calibrated with the log curves of the wells within the field and processed into P-Impedance and S-Impedance data cubes in the AVO Inversion procedure. The resultant data cubes were analyzed with the discrimination of this intra-formational shale being performed on the cross-plot space of a number of parameters derived from the P and S impedance data cubes. In order to assess the robustness of the methodology. a number of sensitivity analyses were employed in the course of the shale isolation process, with converging results from these tests enhancing our confidence.

The project has concluded that the critical intra-formational shale does not form a continuous baffle over the field and hence the higher volumetrics for a combined single-system is supported.

Paper 7

Braided River Channel Bar Identification and Description

GuangJun Chen[1] and Wang Helin[2]

[1]Schlumberger
[2]Petrochina

Abstract

Fluvial sand is an important oil reservoir in the petroleum industry. In fluvial exploration and production, the key to success is the identification of channel sand. However, how to describe the channel is always a challenging and critical task. For a braided river system, the identification of the channel bar plays a significant role in field exploration and development.

One of our recent field studies involved a field located in the shallow sea of the Bohai Bay, and is bounded by two major faults. Its area is less than 30 km^2. There are already 16 wells drilled and some of them have been producing with a relatively high rate. The operator expects to develop this field quickly, but one of the major target layers is a braided river system of fluvial deposition. Though the sands are very developed, only the channel bars are high-quality reservoirs capable of producing oil. How to identify and describe the channel bar is the key to development. Integrated workflow and seismic techniques are needed for this kind of reservoir.

Through vertical seismic profile (VSP) processing, we calibrated the target layers, guided by detailed geological classification and controlled by well logging processing and integrated interpretation. We applied seismic attribute analysis to identify and describe the target braided river channel bar, combined with 3D visualization and traditional sand tracking. Finally, we achieved verifying and validating results that can aid in modeling and simulations, with an aim to optimizing production and development.

Introduction

Braided-bar sedimentation or channel-bar growth occurred in a region of flow expansion, and was probably initiated by the stalling and amalgamation of large dunes. These dunes created a bar-core that grew by (1) propagation of a downstream-accreting slip face, (2) vertical accretion through stacking of dunes on both bar stoss and top, and (3) lateral accretion on the bar margins during recession of the flood hydrograph. Such a braided-bar sedimentation shares many similarities with previous studies of smaller sand-bed braided bars that display the dominance of dune-scale cross-stratification, the presence of large-scale, bar margin cross-stratification, and the occurrence of lateral, vertical, upstream, and downstream accretion. However, the contribution of the bar margin facies to the preserved stratum may have been underestimated in previous studies of braided rivers in which the braided bars were migrating slowly.

This case is a braided-bar reservoir subject to development. The field is located in the shallow sea of the Bohai Bay. The major target block is situated within two major faults and its area is less than 30 km^2 (Fig. 1). There are already 16 wells drilled and some of them have been producing at a relatively high rate. Three major net pay layers were found (Nm, Ng, and Es, respectively), with Ng11 reservoir possessing a relatively high production Ng11 is one major net pay layer which sedimentary facies is braided river of fluvial origin. In the cross section (Fig. 2), red color represents the net pay oil layer and blue color represents water. The cross section also shows one conflict with oil-water contacts around the three major oil wells, namely, well ZH802 has a very shallow water layer above the oil-water contact compartmentalization. Is there a lithology barrier or something else between those wells? Geologically, the bar margin may have played an important role in reservoir formation. Because the operator desires to develop this field quickly, identifying and describing the channel bar between wells is the key to development.

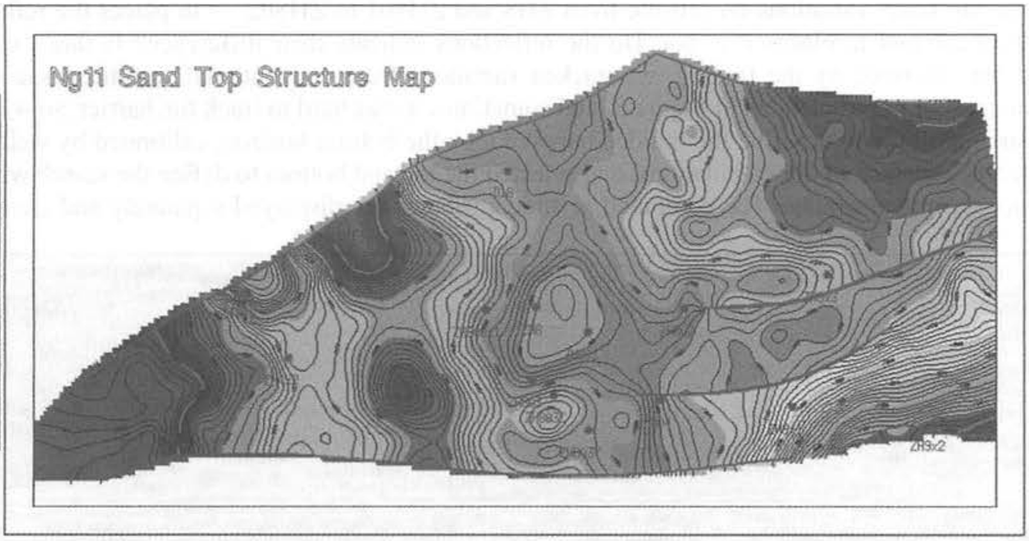


Figure 1. Ng11 sand top structure map. Wells ZH8, ZH801, and ZH803 produce oil, but ZH802, in the same structure and in a similar position, produces water.

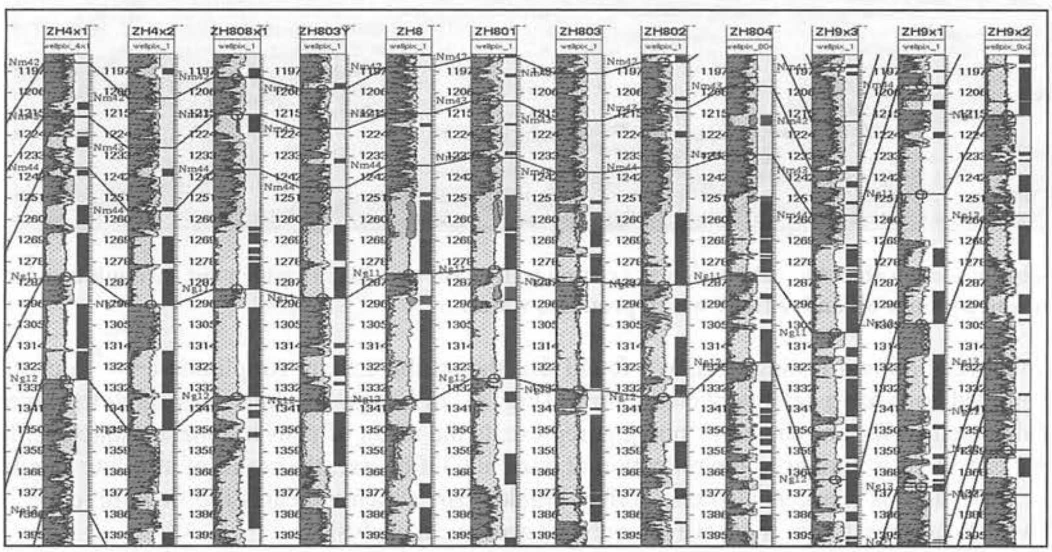


Figure 2. Well by cross section and logging interpretation. Red represents oil layers and blue represents water layers.

Workflow/Method

From logging and geological classification we analyzed the Ng11 sand. There is a thin shale layer at the upper zone from Nm44 to Ng11; sands are always highly developed in existing wells, but big differences exist in the fluids. Of the four wells displayed in Figure 3, ZH808x1 has no oil in Ng11, ZH8 and ZH801 are major producing wells of Ng11, but ZH802 is water-producing above the oil-water contact identified in ZH8 and ZH801. It is one long-term puzzle to understand the reservoir. Although those wells all cut through sands in Ng11, are the sands different? Are there barriers between braided-bar and channel sands? If so, how is one to identify the boundary?

Because there is one VSP log with well ZH8, we can calibrate and mark the sand accurately in seismic profile. In Figure 3, the yellow line shows the top of layer Ng11 and its bottom is marked with green; the orange-filled logging curve is the processed porosity curve. Comparing their reflections, we find there are some variations on seismic from ZH8 and ZH801 to ZH802 — in places the reflection is double peak and in places it is not. Do the reflections indicate their difference? Is this a clue to braided bar? Inspired by the finding, we tracked variations from conventional seismic. Usually the indications were not as clear as in Figure 3, and sometimes it was hard to track the barrier, so we used the seismic attribute to describe the braided bar. We took the bottom horizon, calibrated by well data, as a reference surface of our calculations, and selected the top and bottom to define the search window to extract seismic attributes. The computed seismic attributes are displayed separately and compared

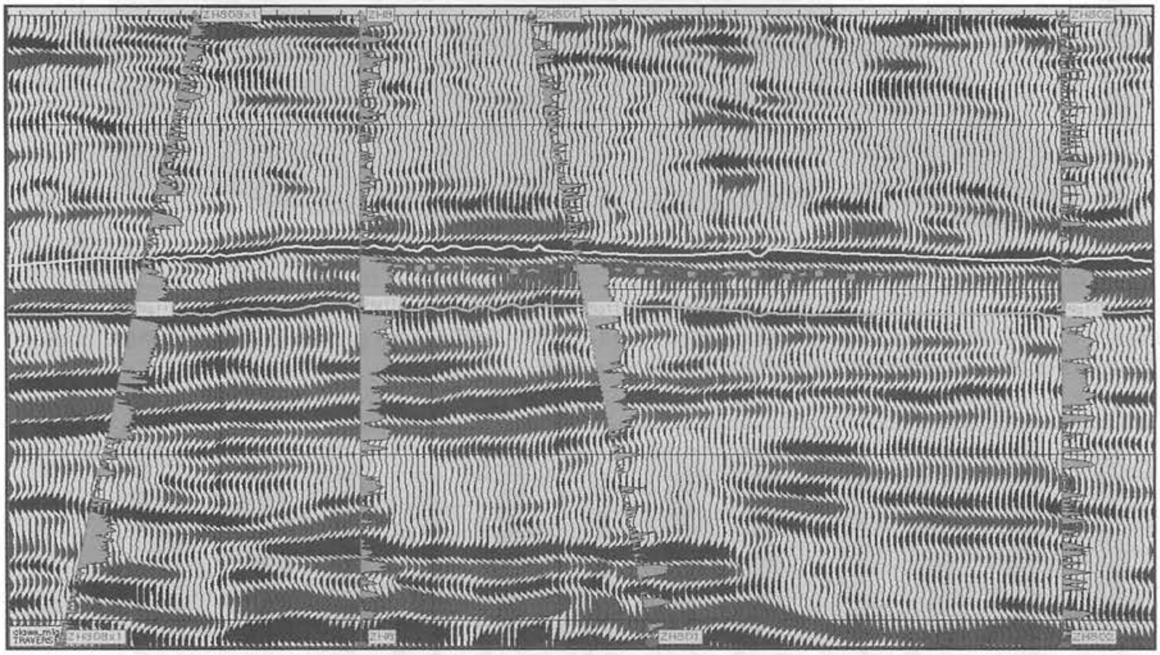


Figure 3. Seismic section showing calibration to existing wells ZH8 and ZH801 which cut through braided channel bar and produce oil and ZH802 which produces water.

with well interpretation and testing data. We found that the attribute Sum_Amplitude ($\sum_i^n A_i$) could reflect the braided bar with a relatively clear barrier (Fig. 4). In Figure 4, white ticks show the layer location of deviated wells, and the black polygon represents the result of conventional seismic events tracking. We can see it is similar to the reflection of attribute. Of course, the result of attribute should be more accurate, and its shape is also one perfect braided bar, which indicates the flow direction is from southwest to northeast; this is consistent with our geological analysis.

In addition, we also used 3D visualization techniques to verify our understanding. To describe the variation of well ZH802, we flattened the seismic along the top of Ng11, and displayed the seismic slice along the top of Ng11 in ZH8. In Figure 5, the braided bar can be identified vividly. There are also differences between wells ZH8 and ZH802.

Hereafter we can identify the braided bar on seismic and predict reservoir distribution around those wells. Wells ZH8, ZH801, and ZH803 were drilled through the braided bar, so net pay oil layers were found in them. However, though ZH802 had cut through some channel sand, there was a lithological barrier between the channel bar and the other sand; they were not connected with each other, therefore there are oil net pay layers in well ZH8 but water in well ZH802. Now we can determine the well pattern and well grid to place development wells around the oil pay zone.

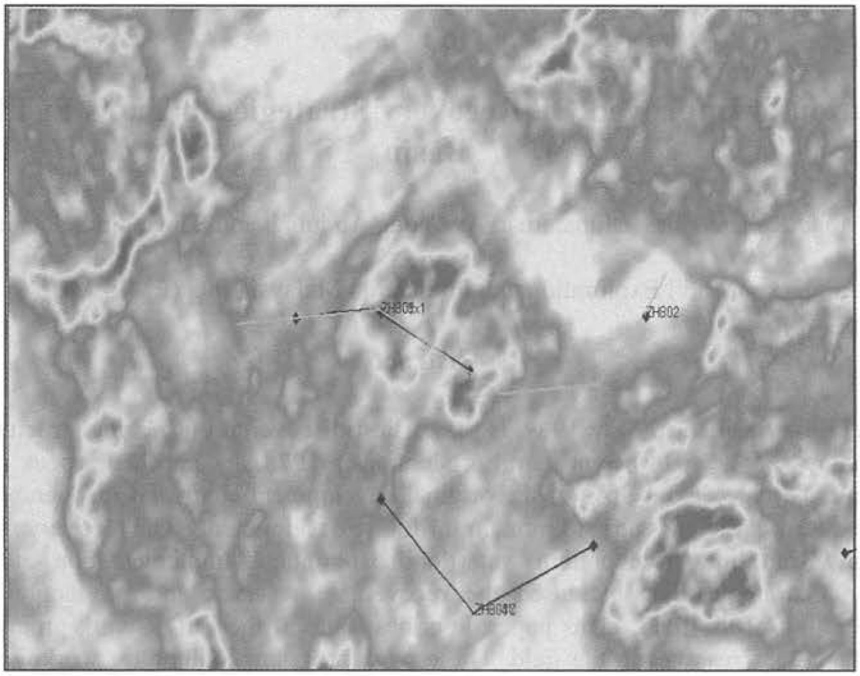


Figure 4. Seismic volume 3D visualization of Ng11 braided channel bar, cut through by three wells.

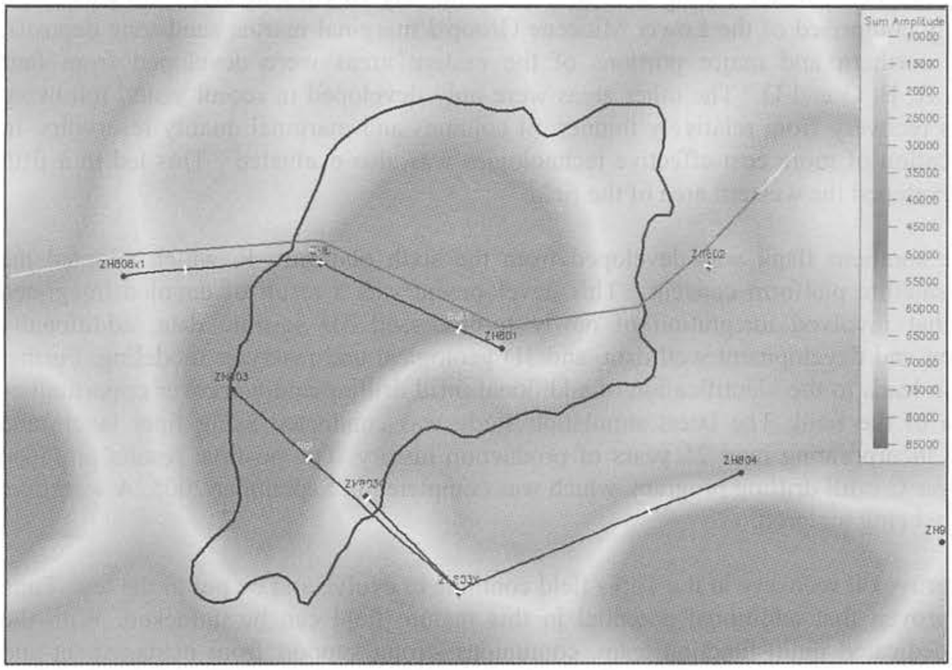


Figure 5. Seismic sum amplitude between Nm and Ng11. Pink and yellow reflect the development and distribution of the braided channel bar, white cross represents Ng11 location for deviated wells.

Discussion/Conclusion

Fluvial sand is a major reservoir of petroleum, but its distribution and variation are always very complex. An integrated workflow is necessary for description of this type of reservoir. The combined application of seismic events tracking, attribute analysis, and 3D visualization allow us to describe the scope of a definite braided channel bar and provide significant information to aid in field development.

Paper 8

Application of Improved Oil Recovery Strategies in Tapis Field, Malay Basin

Mohd Rohani Elias, Muhammad Aw Yong Abdullah and Samsudin Selamat

ExxonMobil Exploration and Production Malaysia Inc. (EMEPMI)

Abstract

The Tapis field, first drilled in May 1969, is the earliest discovered oil-bearing structure in offshore Peninsular Malaysia. The field began its oil production in 1978, and reached a peak rate of 80,000 barrels per day. To date, about 90% of the original development estimated recoverable oil reserves have been produced; large gas caps still remain for future development. The recovery mechanism has been primarily from line drive pattern waterflood. Continuous implementation of improved oil recovery (IOR) strategies has increased the recoverable reserves and production capacity for economic operation of the field. This paper describes some of these IOR work programs that have added more than 25% reserves to the field. These work programs include rig workovers, infill/step-out drilling from existing platforms, and installation of new satellite platforms.

The Tapis structure is an east-west trending anticline, approximately 16 km long and 7 km wide, with oil reservoirs mainly comprised of the Lower Miocene Group J marginal marine sandstone deposits. Initially, only the northern and major portions of the eastern areas were developed from four platforms, namely, A, B, C and D. The other areas were only developed in recent years, following studies to re-assess recovery from relatively thinner oil columns and marginal quality reservoirs. In addition, the application of more cost-effective technologies was also evaluated. This led to a fifth platform, E, that developed the western area of the field.

More recently, the southern flank was developed from the sixth platform, F, which adopted the minimal facilities satellite platform concept. This development was a result of detailed integrated reservoir studies that involved integration of newly re-processed 3D seismic data, additionally acquired exploration and development well data, and 3D geological and reservoir modeling. Further modeling effort also leads to the identification of additional infill drilling and workover opportunities in the eastern area of the field. The latest simulation study was conducted using finer layers and unstructured grids, incorporating over 25 years of production history. The positive results provided justification for Tapis C infill drilling program, which was completed in September 2005. A workover program is currently being matured.

Ideas to further improve oil recovery in the Tapis field continue to evolve and be put to the test. Time and history have proven that additional potential in this mature field can be unlocked. With the combination of a dedicated multi-function team, continuous strong support from management and constructive encouragement from stakeholders, extending the economic production life cycle of the Tapis field is an achievable mission.

Paper 9

Regional Stress State in the Fold Belt Area of PNG and Fine Scale Stress Variation with Implications for Drilling, Exploration and Subsurface Reservoir Characterization

Katharine Burgdorff[1], David Castillo[1], Jon Rowse[2], Gavin Douglas[2], Steve Owad-Jones[2], Jürgen Streit[1], Dan Kendrick[3] and Nigel Wilson[2]

[1] GeoMechanics International, Perth, Western Australia
[2] Oil Search Limited, Sydney, New South Wales, Australia
[3] 3D-Geo, Brisbane, Queensland, Australia

The extensive collection of high-resolution image data in nearly all of the current wells being drilled in the Fold Belt structures within Papua New Guinea (PNG) has contributed valuable subsurface information. Perhaps the most important contribution is the observation that the contemporary stress and pore pressure regimes in the Fold Belt area are not uniform in PNG. Systematic variations in stress orientation and magnitude have been identified and used to enhance subsurface reservoir understanding and improve development drilling and completion operations.

The large-scale regional direction of the maximum horizontal principal stress (S_{Hmax}) is generally oriented in a NE-SW direction. This regional direction is consistent with the deep (> 15 km) earthquakes that occur in the PNG Fold Belt area. For example, the S_{Hmax} stress map seen in the Moran and Southeast Mananda Fields (Fig. 1) indicates a regional S_{Hmax} stress direction that is about NE-SW, which is consistent with the NE-SW compression direction inferred from deep earthquakes. However, there are clear anomalies such as seen in the SE Mananda Field, which indicates a NW-SE S_{Hmax} stress direction.

Inferences of subsurface structure based on seismic data have historically been problematic due to the rugged terrain in the PNG area. Fault geometry and structures have largely been constrained using dipmeter data. Some wells indicate a locally consistent far field S_{Hmax} direction and magnitude profile. However, there are fine-scale and localized wellbore breakout rotations seen in image data within certain wells that indicate local active faulting. This has implications for reservoir compartmentalization and well placement. Figure 2 is an example of how observations of wellbore rotations can be used to investigate the range of possible fault orientations that are active in the current stress regime. By modeling slip along a particular fault plane that may or may not intersect the wellbore, it is possible to constrain the fault geometry and its associated slip to match the breakout rotations. This has implications for using wellbore breakouts to help identify active faults away from the wellbore.

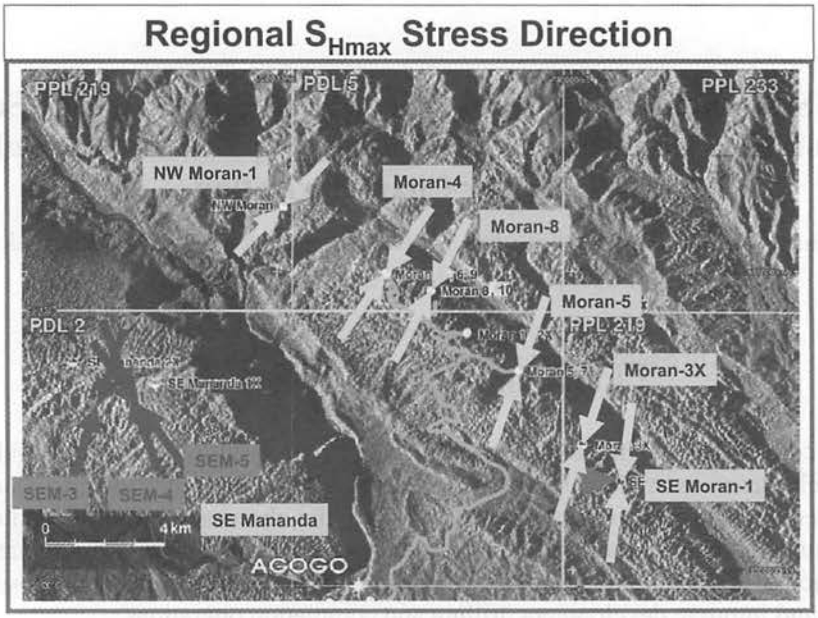


Figure 1. Regional S_{Hmax} stress direction in the NW Moran, Moran, SE Moran and SE Mananda areas. The inward facing arrows correspond to the direction of the maximum horizontal stress inferred from wellbore failure seen in wells drilled in these structures. Although the regional stress state indicates NE-SW compression, there are perturbations from this regional trend such as the NW-SE S_{Hmax} directions seen in the SE Mananda Field.

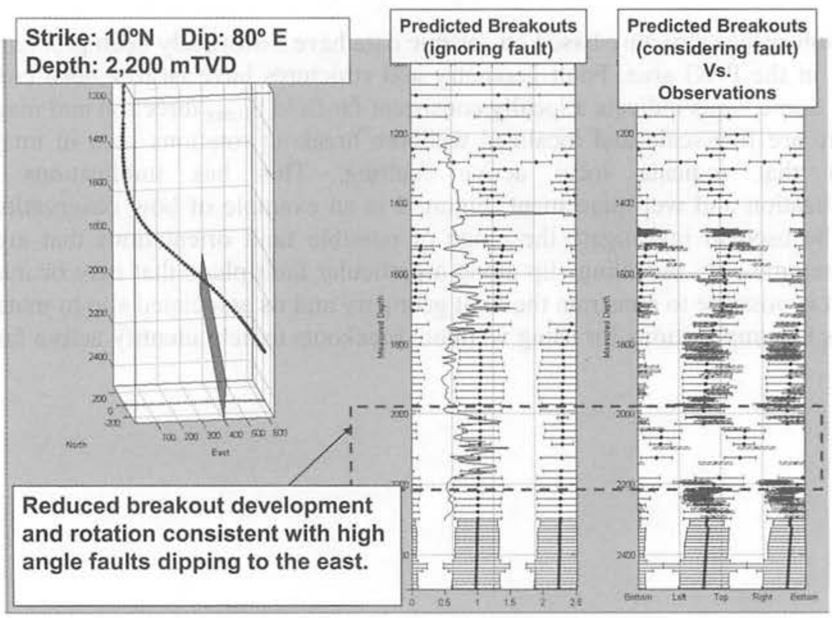


Figure 2. Modeling wellbore breakouts to identify the geometry of active faults responsible for the wellbore breakout rotations in the SE Mananda field. It is possible to model the reduction in wellbore breakout and rotation of the breakout using a fault that is below the well and steeply dipping to the east.

The geomechanical models that are built using image and wireline logs and geological and engineering information for each of the various structures in the PNG area have been used to eliminate many of the problems encountered while drilling these complex structures. For instance, in some wells the non-productive time has been reduced from about 35% to about 3%. Figure 3 is an example of how knowledge of the geomechanical model can be used to identify the appropriate mud weight to prevent hole collapse in any arbitrary well. Contoured in the stereographic projection in Figure 3 is the mud weight required to control, and not necessarily prevent, wellbore breakouts. Well designs that incorporate geomechanics allow the control of breakout development without excessively reducing annular velocities needed to effectively clean the hole. Furthermore, well designs based on geomechanical models help to avoid damage to sensitive reservoirs and also reduce the risk of losses through unstable natural fractures.

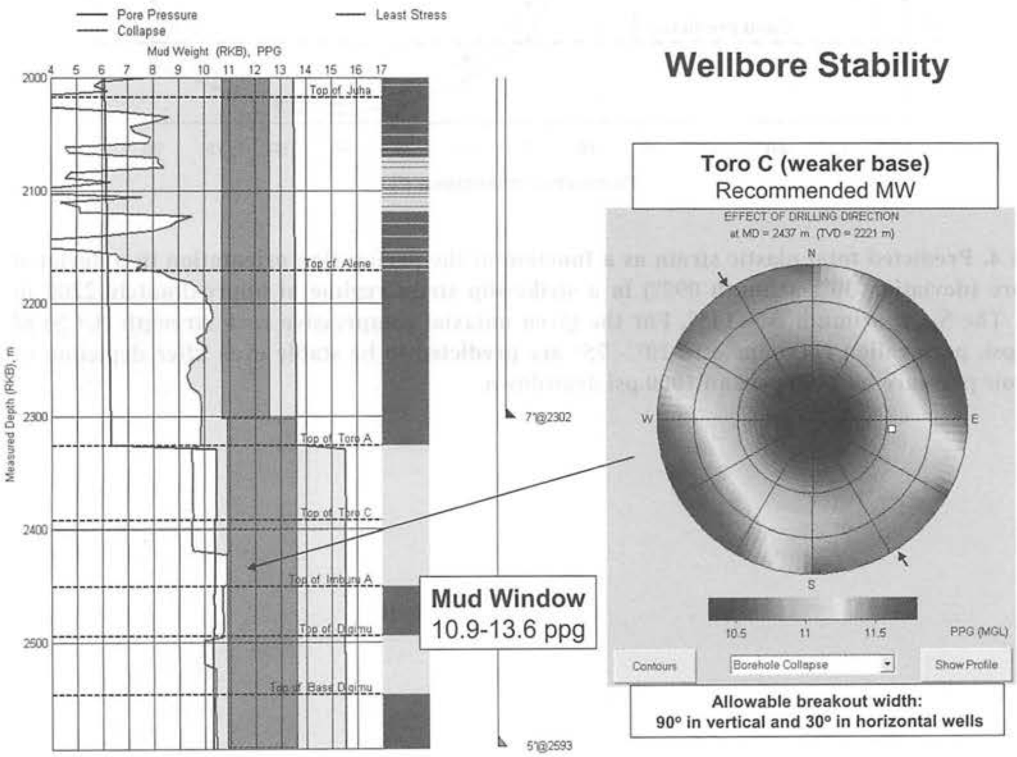


Figure 3. Contours of predicted mud weight required to control wellbore breakout development for any arbitrary well trajectory. Also shown is the pore pressure, fracture gradient and collapse pressure specific to a well in SE Mananda. Wells plot as point in the lower hemisphere stereographic projection where vertical wells plot in the center and deviated wells, depending on hole azimuth, plot on the inner circle (30° deviation) or the second circle (60° deviation) or along the perimeter (90° deviation).

Identifying the optimal completion strategy for the reservoir sands has been accomplished using finite-element modeling and the geomechanical model unique to the structure. Specifically, the geomechanical analysis has been used to identify the suite of sand-free perforation directions appropriate for the drawdown conditions and depletion expectations. Figure 4 is one of many examples of how identifying oriented perforations with the least total plastic strain can be used to prevent sand production prior to completing a particular well.

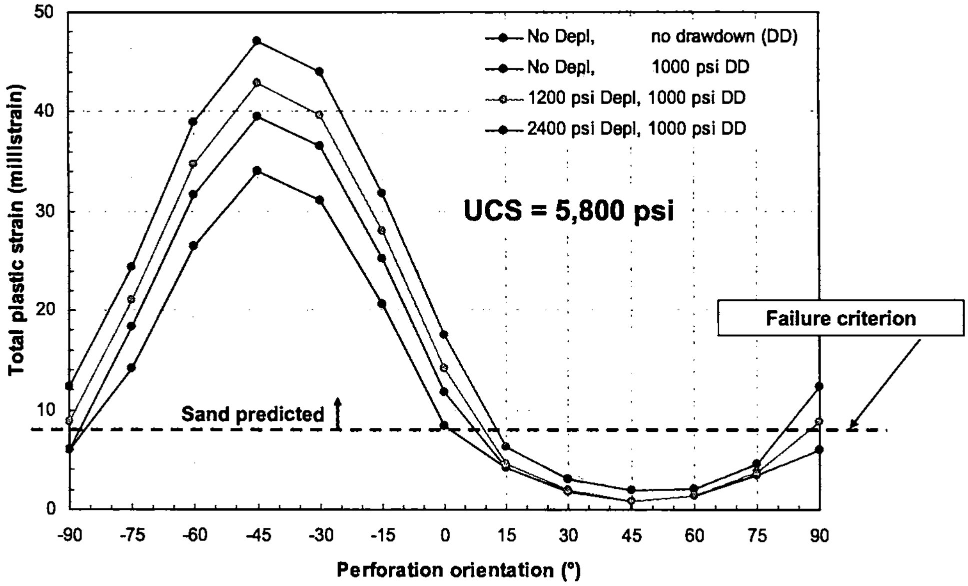


Figure 4. Predicted total plastic strain as a function of the perforation orientation in a deviated wellbore (deviation 30°; azimuth 097°) in a strike-slip stress regime at approximately 2200 m depth. The S_{Hmax} azimuth is ~ 145°. For the given uniaxial compressive rock strength (UCS) of 5,800 psi, perforation rotations of ~ 20° - 75° are predicted to be stable even after depletion of reservoir pressure by 2400 psi and 1000 psi drawdown.

Paper 10

Fault Seal and Fault Stability Risk Assessments for Field Development Planning – Implications for Injection Pressures and Operational Procedures

Adrian White [1], Jürgen Streit [1], Ralf Napalowski [2] and Robin Hill [2]

[1] GeoMechanics International, Perth, WA, Australia.
[2] BHP Billiton Petroleum Pty. Ltd., Perth, WA, Australia.

Shear failure along faults can increase fault permeability, and, in the proximity of hydrocarbon reservoirs, and in addition, compromise the integrity of fault-bounded traps. Field-specific geomechanical models for the Eskdale and Stybarrow fields, offshore Exmouth sub-basin are used to assess the risk associated with slip along faults that bound or are contained within the reservoirs. Such assessments require robust geomechanical models because the magnitudes and orientations of the contemporary stresses and pore pressure acting on the faults, together with the fault geometries, determine whether faults have the potential for shear failure. This study was undertaken to assess whether the faults in the Stybarrow field will behave as barriers that could hinder water flooding sweep efficiency. In the Eskdale field, fault stability was assessed in the context of gas injection.

A geomechanical model requires knowledge of the *in-situ* stress orientations and magnitudes, the pore pressure and the effective rock strength. Fault seal and stability analyses require depth-continuous profiles for all three principal stresses, the pore pressure and the Biot coefficient. The geomechanical models for the Stybarrow and Eskdale fields indicate that the area is associated with a strike-slip contemporary stress regime ($S_{hmin} < S_V < S_{Hmax}$) where the maximum horizontal stress is oriented approximately 120°N. Pore pressure is hydrostatic.

Fault seal and stability assessments require knowledge of the stress, fluid pressure and the coefficient of friction (μ) on faults to understand the conditions that may lead to fault slip. Fault zones are generally associated with a coefficient of friction that ranges from 0.6 to 0.85 (Byerlee, 1978). In the absence of information on the cohesive strength of any of the faults, all faults were assumed to be cohesionless.

The fault sealing and stability assessments were conducted using GMI's fault stability software, GMI•FaultSeal™. This software uses the geomechanical model and fault geometry to calculate the shear and normal stresses acting on individual fault segments. The sealing capacity of each fault segment was calculated in terms of the Critical Pore Pressure (CPP) and the Critical Pressure Difference (CΔPp). The Critical Pore Pressure (CPP) is the fluid pressure acting on the fault surface that is required to be exceeded in order for the fault to become unstable and slip. The Critical Pressure Difference (CΔPp) is the pressure increase above the current pressure conditions required to cause reactivation. In the case of the Stybarrow and Eskdale fields, the Critical Pressure Difference (CΔPp) is the increase in fluid pressure above hydrostatic pressure required to cause fault slip.

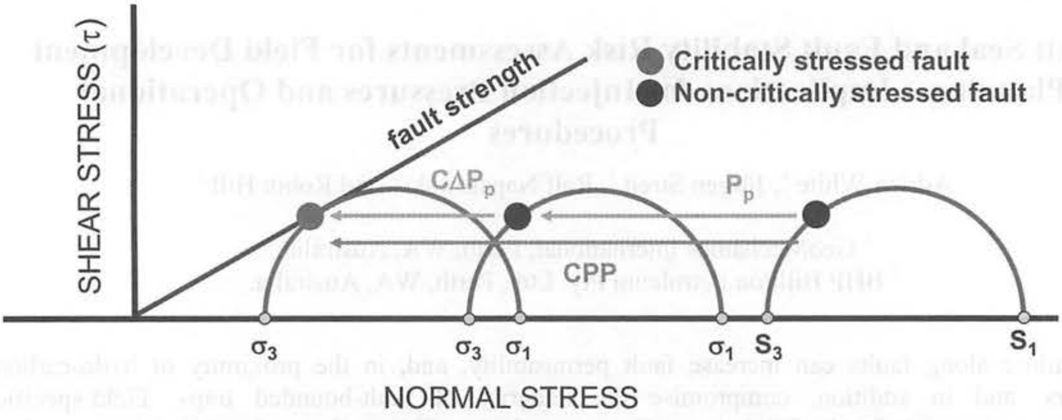


Figure 1: Schematic Mohr diagram showing maximum and minimum principal stresses without any pore fluid present (S_1 and S_3, right Mohr circle), maximum and minimum effective principal stresses in the presence of pore fluid pressure (σ_1 and σ_3, middle Mohr circle) and the effective stress state required to reactivate faults (left Mohr circle). Also shown are the effect of ambient pore pressure (Pp), the Critical Pore Pressure (CPP) and the Critical Pressure Difference (CΔPp).

Most of the faults in the Stybarrow field are sub-vertical and strike N-S to NE-SW. The fault shown in Figure 2 from the Stybarrow field is a perspective view where the fault surface is contoured according to the Critical Pore Pressure required to induce fault slip. Warm colors such as reds and oranges represent a greater risk of fault slip while cool colors (greens and blues) represent relatively more stable segments of the fault. Overall, faults in the Stybarrow field are relatively stable. No segment of the faults in the Stybarrow field is critically stressed in the present-day stress field. In relative terms, faults that strike ~30° to S_{Hmax} have the highest risk of slip activation upon excessive pressurization. The fault segments that are very stable tend to strike nearly orthogonal to the S_{Hmax} direction.

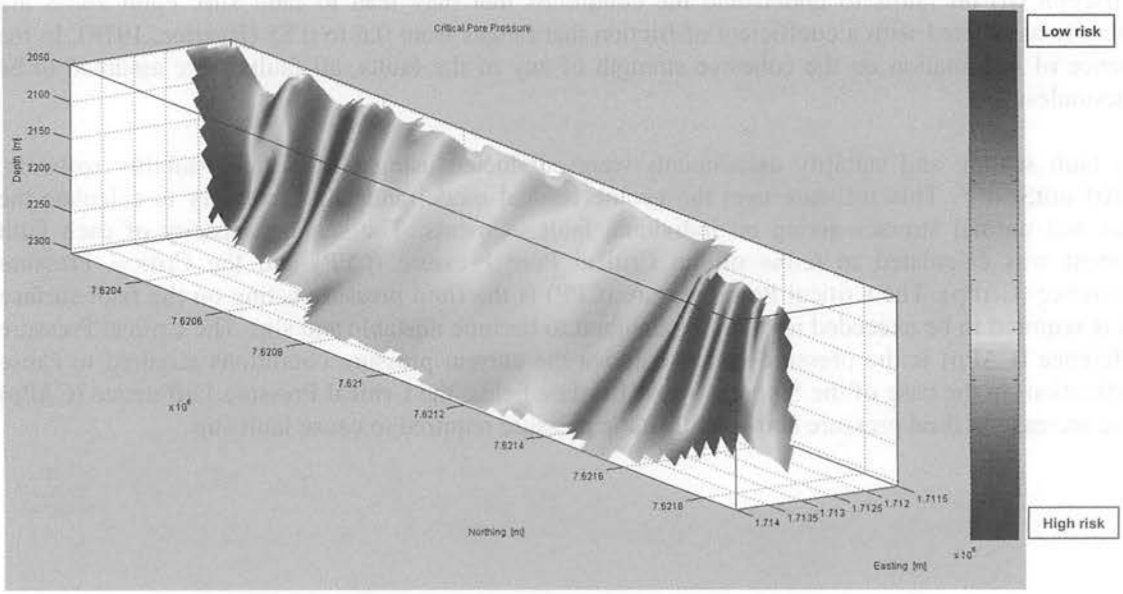


Figure 2: Example fault from the Stybarrow field contoured for the Critical Pore Pressure required to cause fault slip (view to the SW).

Faults within the Eskdale field tend to have N-S strike. Overall, the risk of fault slip failure is low in the area since no segment of the faults in the Eskdale field is critically stressed in the present-day stress field. Modeling along both faults indicates that some of the shallowest segments of the faults are more prone to shear failure if high injection pressures are to be used in the field (Fig. 3).

Conversely, faults within the Stybarrow field are at greater risk of slip because they require smaller increases in fluid pressure for reactivation than faults within the Eskdale field. In both fields, steeply-dipping fault segments that are oriented approximately 30° to S_{Hmax} are at greatest risk of reactivation.

The results of this fault seal and stability study have several implications for field development. For instance, using high mud weights while drilling the development wells may cause reactivation of faults that are at the threshold of slip failure if they are intersected by the wellbore. Identifying this critical mud weight is crucial to maintaining the stability of the faults and preventing losses while drilling. In the case of water injection in the Stybarrow field, it is important to identify the critical injection pressures in the proposed injector wells to avoid fault reactivation. If there are changes in the absolute pore pressure due to injection and production, there may also be changes in

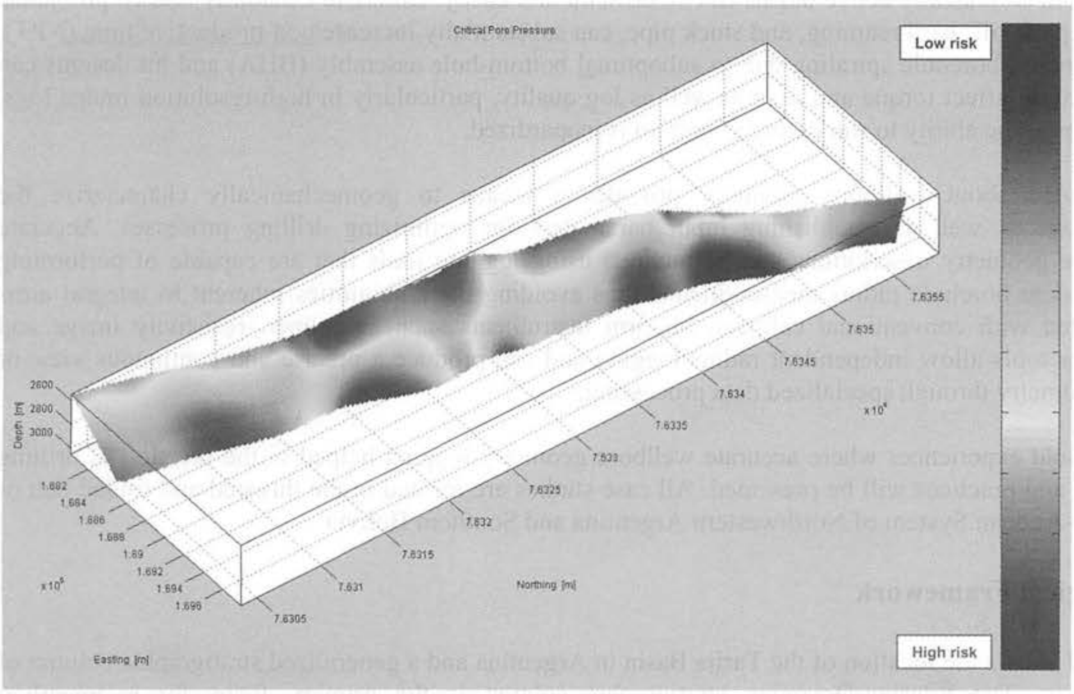


Figure 3: An example fault from the Eskdale field contoured for the Critical Pore Pressure required to cause fault slip (view to the NW).

magnitude of the horizontal stresses. Therefore, it is important to understand the pressure conditions that can lead to fault reactivation especially if there is insufficient pressure drive during production to maintain initial pressures within the fields. If the injection pressures are high, hydraulic fractures could be created and they will propagate in the direction of S_{Hmax}. Fractures propagating in this direction could be problematic if injector wells are located close to faults within the Stybarrow field as propagating hydraulic fractures might intersect the existing faults. It is, therefore, necessary to consider, and possibly control, the extent of hydraulic fracturing from injector wells in order to reduce the risk of causing fault reactivation at fluid pressures required to propagate hydraulic fractures.

Reference

Byerlee, J. (1978): Friction of Rocks. *Pure and Applied Geophysics*, 116. 615-26.

Paper 11

Accurate wellbore geometry logging enhances geomechanical modeling and drilling optimization practices

Martin Paris and Seehong Ong
Baker Atlas

Introduction

Drilling in tectonically active basins can be difficult and costly. Borehole instability related problems, such as pack-off, hard reaming, and stuck pipe, can substantially increase non-productive time (NPT). Additionally, borehole spiraling due to suboptimal bottom-hole assembly (BHA) and bit designs can significantly affect torque and drag as well as log quality, particularly in high-resolution image logs. Oftentimes, the ability to run casing to bottom is jeopardized.

Knowledge about wellbore geometry provides a means to geomechanically characterize the formations as well as establishing input parameters for optimizing drilling processes. Accurate wellbore geometry descriptions can be attained using logging tools that are capable of performing independent borehole radius measurements, thus avoiding the ambiguities inherent to integral arms associated with conventional calipers. Six-arm instruments such as caliper, resistivity image and dipmeter tools allow independent radius logging and can produce a precise and continuous view of well geometry through specialized data processing.

Three field experiences where accurate wellbore geometry logging helped in the revision of drilling designs and practices will be presented. All case studies are located in the thrusted and folded belt of the Sub-Andean System of Northwestern Argentina and Southern Bolivia.

Geological Framework

Figure 1 shows the location of the Tarija Basin in Argentina and a generalized stratigraphic column of the Basin. The Silurian-Devonian stratigraphic column is the primary focus for hydrocarbon exploration and exploitation as it contains both the source rock and the major reservoirs. The latter consist of gas-condensate bearing, fractured quartzites. The main formations of the stratigraphic column are:

Kirusillas–Lipeon: predominantly Silurian shale with hydrocarbon source rock characteristics.
Santa Rosa: predominantly psammitic rocks of the Lower Devonian which forms a thickening-upward and normal grading bed sequence.

Icla-Huamampampa: Middle Devonian shale culminating in quartzitic sandstone (Huamampampa) which forms a perfect thickening-upward and normal grading bed sequence.

Los Monos: thick package of Middle-to-Upper Devonian shale interbedded with sandstone of little continuity and thickness. It is the main source rock and is overlain by the Carboniferous Tarija and Tupambi Formations.

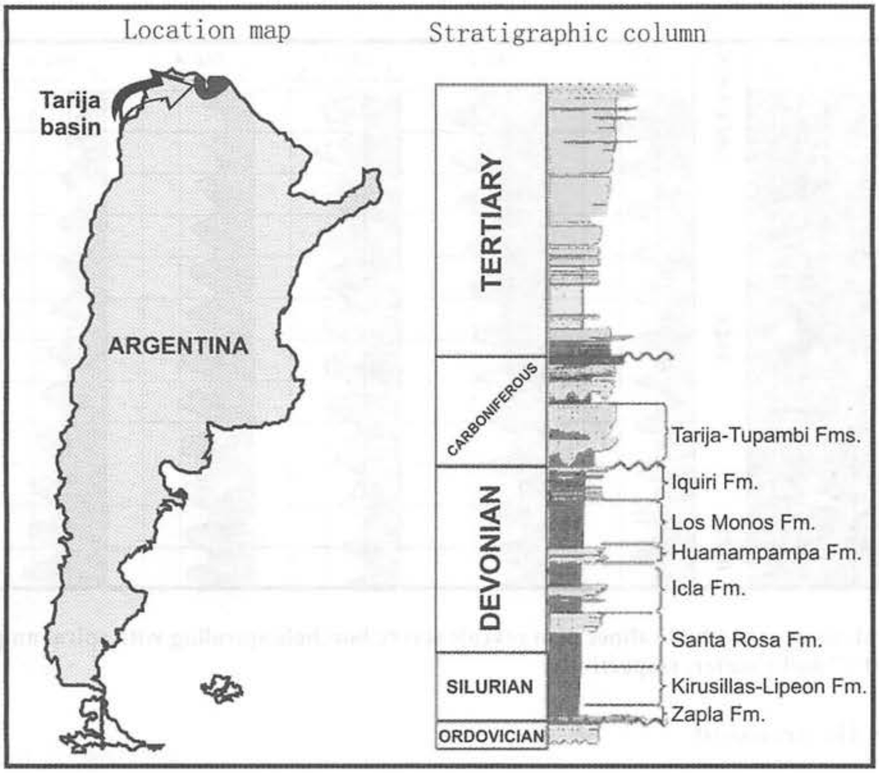


Figure 1: Location of the Tarija Basin in Argentina and a generalized stratigraphic column of the Basin

Case Study I: Hole Spiraling

The well, having a deviation of 20°, was drilled in the Acambuco area by Pan-American Energy using an 8.5" PDC bit with downhole motor. While drilling, the well recorded numerous occasions where the reach of the BHA was curtailed when trying to drill in sliding mode. To overcome BHA 'hung-up', drilling was done in rotating mode in addition to performing many reaming runs.

Analysis of the six-arm caliper data from this well suggests severe borehole oscillation or spiraling. Figure 2 shows that the 'small' spiral has an amplitude of 1" and a wavelength of 1 meter. The latter is consistent with theoretical predictions as the distance between the bit and the first stabilizer (the pivot point) is 1 meter. With characteristics and evidence of spiraling defined, operating parameters such as bit speed, penetration rate and bit aggressiveness as well as BHA stiffness can be modified to minimize oscillation. As no further drilling was made after this well, the improvement in hole quality cannot be ascertained. However, field experience has shown that by optimally selecting bit and BHA parameters, borehole spiraling can be significantly reduced.

When using six-arm caliper to characterize borehole geometry and detect borehole spiraling, it is important to look at individual caliper radii data rather than the three diametric caliper data sets (C1, C2, and C3). This is because C1, C2 and C3 often do not show oscillation about the mean path making it difficult to observe instances of borehole spiraling.

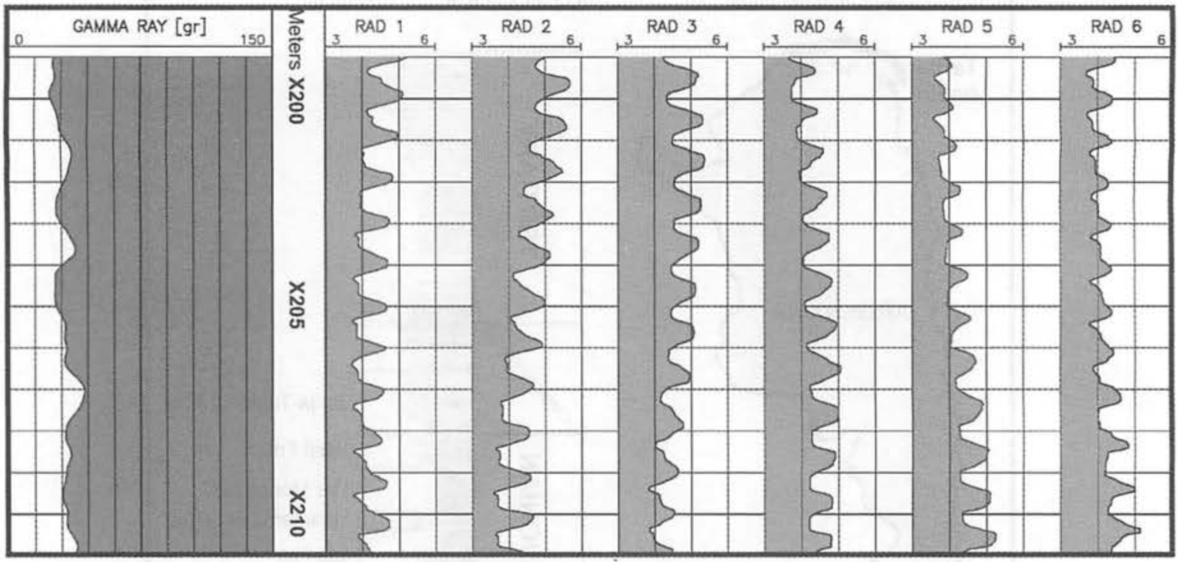


Figure 2: Analysis of individual caliper arm reveals severe borehole spiraling with spiral amplitude and wavelength of 1" and 1 meter, respectively.

Case Study II: Breakout

The Aguaragüe Field, operated by TECPETROL S.A., consists of a NNE-SSW trending anticlinal structure of large longitudinal extension. The naturally-fractured sandstone reservoir age produces gas from the Devonian Huamampampa formation. Characterizations of fractures are carried out using acoustic and resistive image logs.

Figure 3 shows the direction of fast shear which indicates the N-S strike of fractures is consistent with the fracture orientation interpreted from borehole image log. Hence, for this interval the acoustic anisotropy is useful for detecting and characterizing fractures.

However, in a slightly deeper interval the acoustic anisotropy is striking in the E-W direction (Fig. 4). This anomalous anisotropy (up to 32%) is recorded in the interval where breakout is also occurring. Cross-sectional views mapped using six-arm caliper data show the borehole is extremely elongated due to the breakouts. Note that the differential caliper reaches 12" suggesting that the breakout penetrates around 6" per wing. This relatively deep breakout can cause the acoustic waves to travel longer in the major axis (compared to the minor axis) which, in conjunction with (possible) larger dispersion effects along the major axis, results in the apparent anisotropy.

Figure 5 compares the breakout shapes derived using 1-arm, 2-arm and 6-arm calipers. Borehole shape can only be accurately described combining information from 6-arm caliper (breakout length) and acoustic image log (breakout size). These breakout properties are useful in describing in-situ stresses as well as calibrating the geomechanical model. Using the calibrated geomechanical model, subsequent well trajectories were modified and observations of the high angle and horizontal wells indicated that borehole breakout occurrence was drastically reduced.

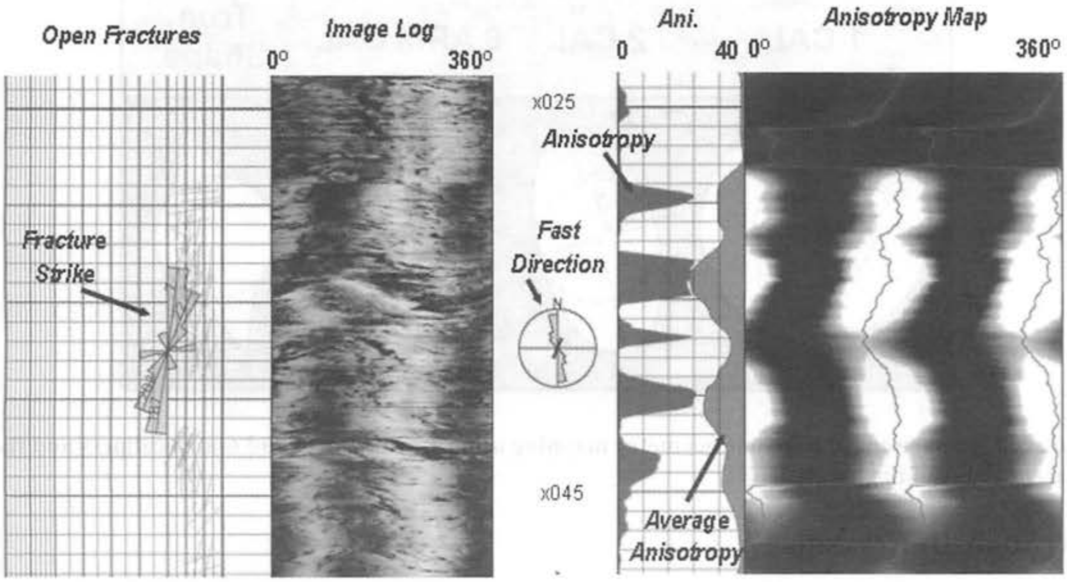


Figure 3: Image and acoustic anisotropy logs show consistency in fracture strike which is approximately N-S over this interval.

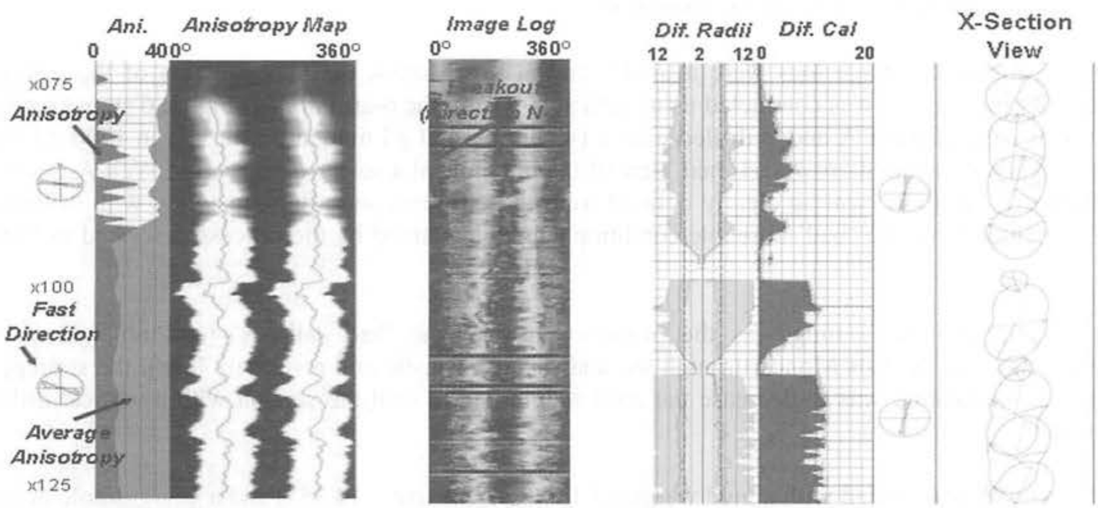


Figure 4: The apparently high acoustic anisotropy over the interval is caused by the presence of relatively deep breakout which can only be delineated by combining breakout width and borehole geometry from image log and 6-arm caliper, respectively.

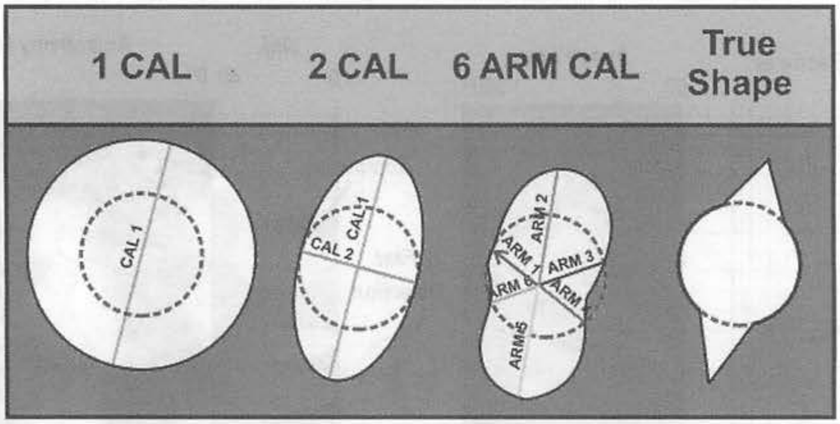


Figure 5: Comparisons of borehole geometry mapping using 1-arm, 2-arm and 6-arm calipers and the apparent shape of the borehole.

Case Study II: Keyseating

The Ramos Field, operated by PLUSPETROL S.A., consists of a NNE-SSW trending anticline of large longitudinal extension. The naturally-fractured sandstone reservoir produces gas from the Devonian Huamampampa formation. The Huamampampa is overlain by the Los Monos formation, which is a thick sequence of shale and siltstone and has traditionally been very difficult to drill. The most common operational problems, such as high drag while retrieving BHA as well as tool sticking, were initially believed to be due to mechanical instability. This initial prognosis together with the occasional presence of overpressures in some fields in the Tarija Basin prompted higher mud weights to be used when drilling through the formation.

Since no borehole image logs were available in the Los Monos, the identification of the wellbore instability mechanism was conducted using data solely from the 6-arm diplog. Figure 6 shows a cross-sectional view of wells A and B drilled with a 14" bit in 1450 g/l mud and a 12" bit in 1500 g/l mud, respectively. A detailed cross-sectional view of the borehole at a selected interval in Well A is shown in Figure 7. With keyseating clearly defined from these figures and after consulting with drilling, it was concluded that the 'bad' borehole condition can be explained by the process described in Figure 8.

Recognizing that keyseating was the primary cause of the 'bad calipers' (and no evidence of overpressures in the Los Monos through the analysis of acoustic and resistivity logs), the strategy to minimize keyseating was to decrease the mud weight and to drill the section with a vertical drilling system.

The next well was drilled with a mud weight of 1340 g/l (bit size = 14.75") and a straight-hole drilling device. The six-arm caliper data (Fig. 9) indicates a much improved borehole shape after implementing the new drilling practices. Unfortunately, due to tool problems the lower section of Los Monos formation was not logged. Nevertheless, there were ample drilling evidences of marked improvements in the borehole conditions. Figure 10 summarizes the superiority of using 6 independent borehole radius measurements over the conventional 2-arm caliper to describe borehole geometry.

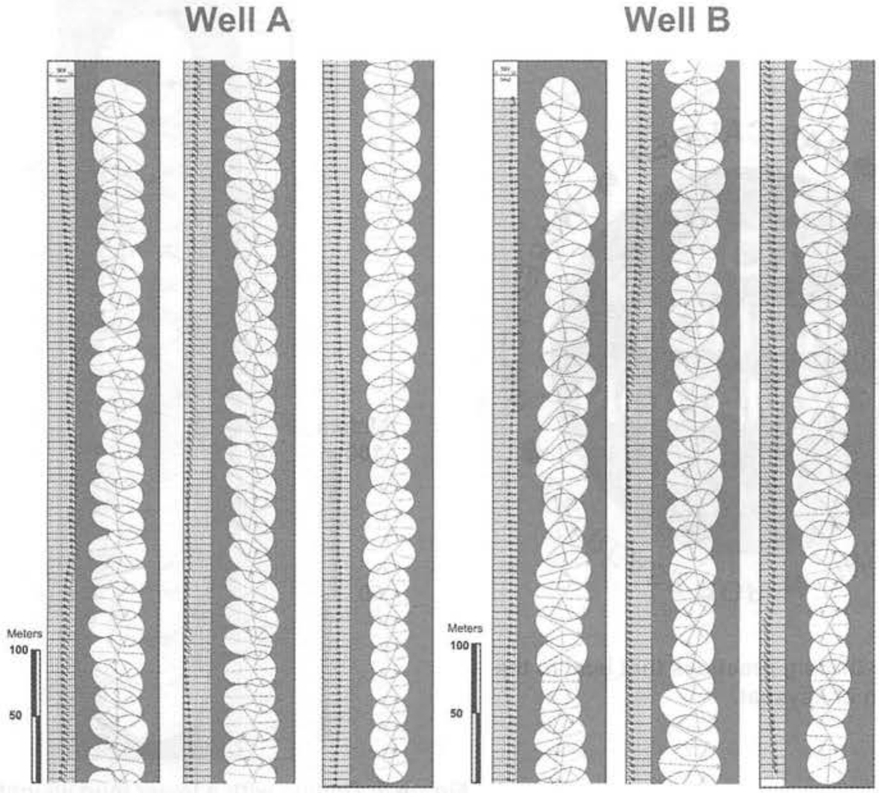


Figure 6: Borehole shapes mapped from 6-arm diplog data. Note Track 1 is the borehole deviation/ azimuth.

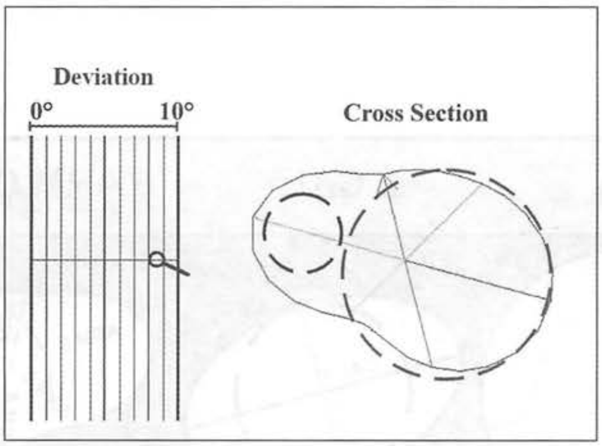


Figure 7: Definition of keyseat from a cross-sectional view of the borehole derived from 6-arm diplog. The big circle is generated by the bit (red dotted line) while the small circle is created by the drill pipes (blue dotted line). This hole is bigger than drill pipes due to the lateral vibrations of the drill pipes during drilling. Keyseat is located at the lowside of the borehole wall (compare with borehole deviation/azimuth in Track 1).

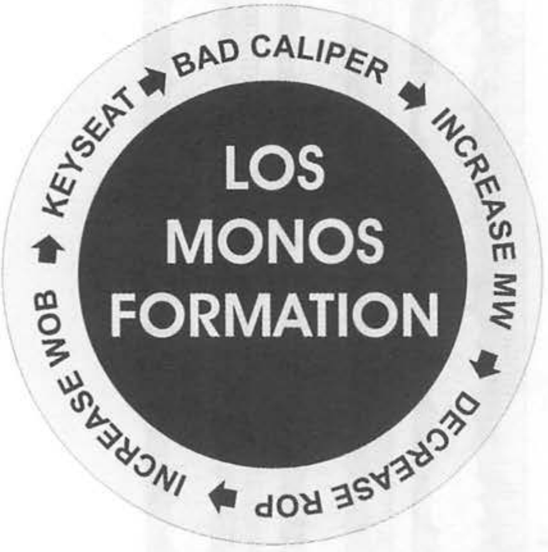


Figure 8: Drilling practices that lead to the formation of keyseat.

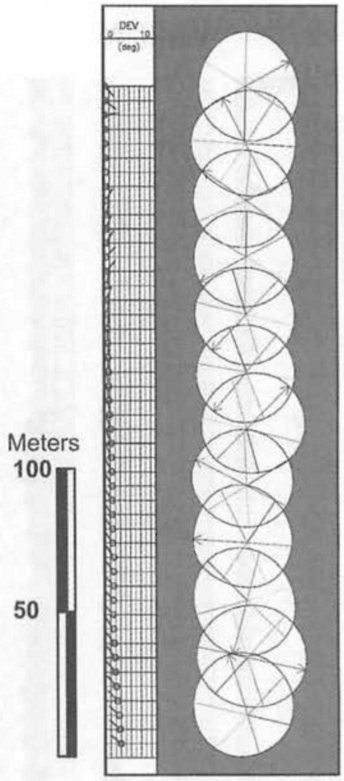


Figure 9: Drilling with a lower mud weight and a vertical drilling system shows a marked improvement in the borehole conditions.

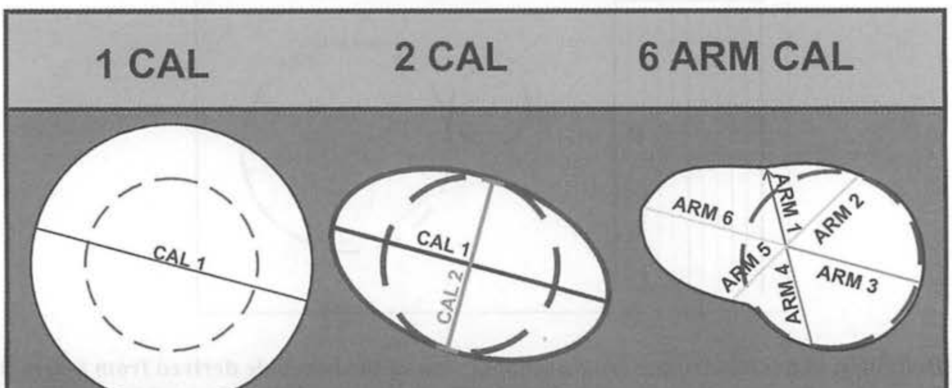


Figure 10: Comparison of borehole geometry generated using different caliper configurations. Note only the 6-arm instrument provides an accurate description of the borehole shape.

Conclusions

This paper addresses the fact that accurate wellbore geometries can only be defined with six-independent radius measurements. For drilling applications, an accurate description of wellbore geometry is critical to the understanding of causal mechanisms associated with operational problems resulting from borehole instability and oscillations.

Acknowledgements

The authors would like to thank Pan American Energy, TECPETROL S.A. and PLUSPETROL S.A., for their permissions to use some of the data for this paper. Thanks are also extended to the management of Baker Atlas for the support and permission to publish this paper.

Bibliography

Disalvo, A. and Villar, H.(1999): Los Sistemas Petrolíferos del Area Oriental de la Cuenca Paleozoica Noroeste, Argentina. IV Congreso de Exploración y Desarrollo de Hidrocarburos, Mar del Plata, Argentina, 1999, pp. 83-100.

Gomez Omil, R. and Luquez, J. (1998): Ramos Field, A Giant Gas Field in a Sub-Andean Belt (NW Argentina). AAPG International Conference & Exhibition, Río de Janeiro, 1998, pp. 986-987.

Hofmann, C. and Paris, M. (2005): Use of Borehole Image Logs as a Planning Tool in Directional Drilling. VI Congreso de Exploración y Desarrollo de Hidrocarburos, Mar del Plata, Argentina, SPWLA , 2005, pp. 9-22.

Pastusek, P. and Brackin, V. (2003): A Model for Borehole Oscillations. SPE paper 84448 presented at SPE ATCE in Denver, Colorado, 2003.

Stark, D. (1995): Silurian-Jurassic Stratigraphy and Basin Evolution of Northwestern Argentina. In "Petroleum Basins of South America." AAPG Memoir 62, 1995, pp. 241-267.

Poster 1

Reducing exploration risk and uncertainty in the Gulf of Thailand and on the Khorat Plateau – The role of tectonics, palaeodrainage and Earth System Modelling

John M. Jacques, Kerri L. Wilson, Paul J. Markwick, David G. Wright and Claudia Fintina

GETECH, University of Leeds, Leeds, LS2 9JT, U.K.

Abstract

In this paper, we highlight the importance of evaluating alternative geological models, and integrating high-quality gravity and magnetic data with other geological datasets (e.g., seismic, well and outcrop) to thoroughly constrain tectonic and structural interpretations for the Mesozoic and Tertiary petroleum systems of the Khorat Plateau and Gulf of Thailand, respectively. In particular, we focus on the fundamental importance of using this approach for developing a plate tectonic model for the entire region that can be used to gain an invaluable insight into the most fundamental issues surrounding the petroleum systems of both its onshore and offshore basins, particularly for frontier areas with limited seismic and well data; thus ensuring that the resultant plate tectonic model is as robust as the data we have will dictate, and the ensuing modelling techniques employed, such as palaeodrainage analysis, will take us closer to reducing uncertainty and exploration risk in frontier areas.

Using GIS technology, the tectonics, geophysics, geochemistry and sedimentology of the region have been digitally captured, attributed and integrated, allowing us to spatially and temporally analyse the data, in order to identify new and extend existing play concepts. When this is combined with the application of GIS-based state-of-the-art techniques, such as 'Earth System Modelling' (e.g., palaeoclimate and ocean modelling), a very powerful exploration tool is created for predicting the contemporary distribution of play elements (source, reservoir and seal). However, the reliability of such modelling is greatly dependant on having a thorough understanding of the tectonic evolution of the region – thus highlighting the importance of integrating potential field data with seismic and well – especially the influence of tectonics on basin dynamics (subsidence/uplift) and its associated landscape evolution (hinterland uplift, palaeodrainage, sediment supply and input). Captured through GIS, the 'final analysis' on exploration potential for the region will be visually portrayed through a set of tectonic, palaeogeographic and landscape dynamic maps.

Tectonostratigraphic provinces and petroleum systems

Based on inter-basinal characteristics that include spatial (geographic association, e.g., rift geometry), temporal (e.g., source rock age) and mechanistic (e.g., trap style) similarities, it is clear, on a gross-scale, that the Khorat Plateau and the basins of the Tertiary rift systems offshore (Gulf of Thailand) and onshore (Fig. 1), can be grouped into three megaprovinces according to their tectonostratigraphic history and petroleum systems; which, named here, we refer to as:

(1) The **'Mesozoic Khorat Plateau Basin Province'**, comprising of the Ubon, Khon Kaen, Vientiane, Sakon Nakhon and Savannakhet sub-basins;

(2) The **'Tertiary Western Thai Intra-cratonic Rift Province'**, which includes the offshore Hua Hin, Western, North Western, Kra, East Kra (Rayong), Chumphon, Paknam, Prachuap, Chumphon, Songkhla Sakhon basins, and the onshore Chiang Mai, Phrae, Pua, Nan, Mae Sod, Phitsanulok, Mae Sot, Lampang, Suphan Buri., Ayutthaya, Fang, Mae Sai, Phetchabun, Nong Bua, Lad Yao, Nakhon Sawan, Kamphaeng Saen, Thon Buri basins;

(3) The **'Tertiary Eastern Thai Intra-cratonic Rift Province'** that includes the Pattani, Khmer, North Malay and Malay basins.

On a regional-scale, offshore, the Tertiary Western and Eastern Thai Intra-cratonic Rift Provinces are separated by the Three Pagodas Fault System, which is interpreted here as representing a NW-SE-trending zone of diffuse intraplate deformation comprising of an anastomosing network of basement fractures that define basin bounding faults and, in turn, interbasinal highs. Representing a possible subplate boundary, the NW-SE-trending intracontinental 'Three Pagodas Deformation Zone' appears to define the boundary between two contrasting tectonic domains, which can be separated based on their basin characteristics, such as overall geometry, depth-to-basement, heatflow and subsidence mechanism(s). The differences in the mechanistic response of the crust during intra-cratonic rifting and thermal subsidence between the two tectonic domains has, to a large extent, controlled their tectonostratigraphic evolution (palaeodepositional environments) and ultimately, their petroleum systems. In someway, this is crudely illustrated by the distribution of hydrocarbon accumulations and fluid type, with the 'Tertiary Western Thai Intra-cratonic Rift Province' being dominated by oil and the 'Tertiary Eastern Thai Intra-cratonic Rift Province' by gas and gas condensate (Figure 1).

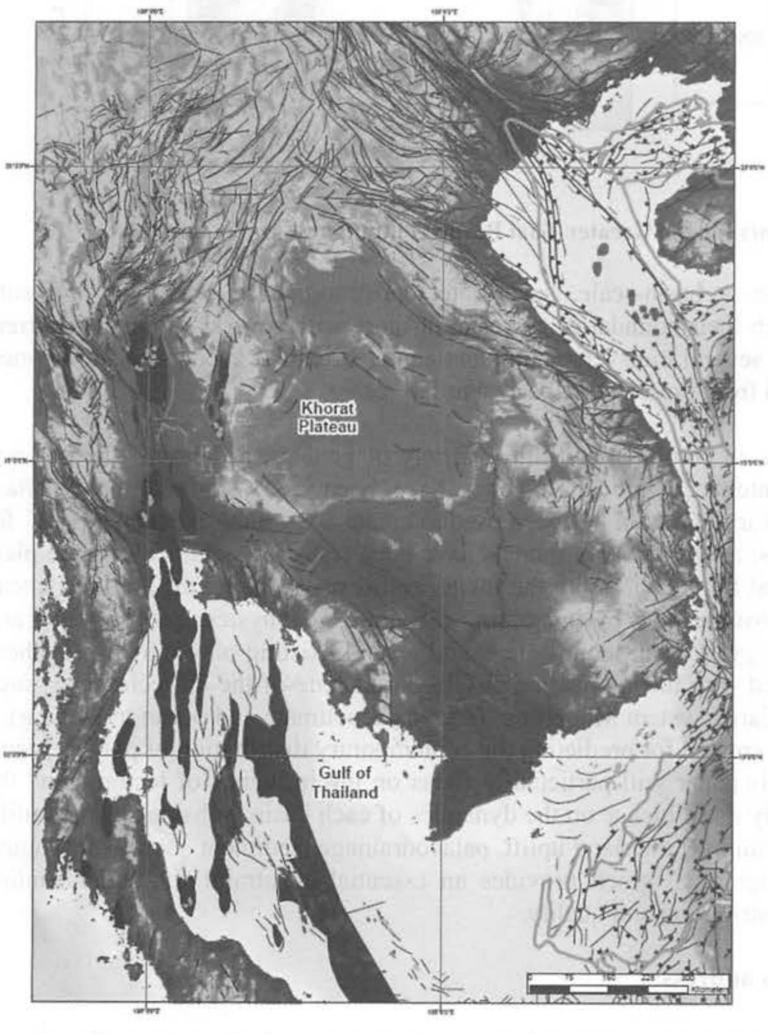


Figure 1. Location of the Tertiary intra-cratonic rift basins in the Gulf of Thailand and onshore (black), and the distribution of hydrocarbon accumulations (green: oil; red: gas and gas condensate).

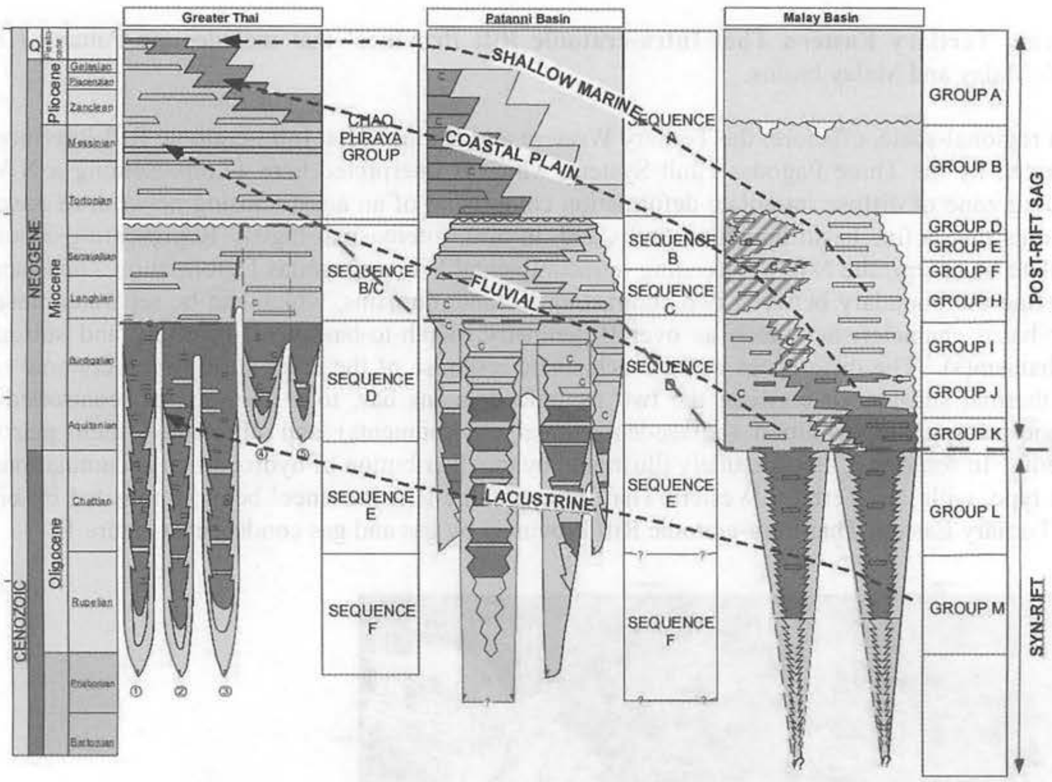


Figure 2. Depositional environments for the Greater Thai Basins, Pattani and Malay basins.

Within each 'megaprovince', on a basin-scale, several tectonostratigraphic provinces and sub-provinces are recognised in which their boundaries correlate onshore with several major transcurrent fault systems and, offshore, with several transverse, intracontinental structural accommodation zones, both likely to have been inherited from pre-existing basement fabrics.

Using gravity and magnetic data, in combination with a variety of geological datasets, the position and continuity of these intraplate accommodation zones have been assessed, and the resultant structural/geological framework for the region has been used to create a regional 'palaeotemplate' for plate tectonic modelling purposes; and alternative models have been tested by continental-scale plate tectonic modelling of the potential field data. With the focus, in this paper, being the Khorat Plateau and Gulf of Thailand, we demonstrate how by integrating tectonics, geophysics, geochemistry and sedimentology with GIS technology, we can identify new and extend existing play fairways in these frontier areas and, when combined with the application of GIS-based state-of-the-art techniques, such as palaeodrainage analysis and 'Earth System Modelling' (e.g., palaeoclimate and ocean modelling), a very powerful exploration tool is created for predicting the contemporary distribution of play elements (source, reservoir and seal). This paper will particularly focus on the influence of tectonics on the evolution of this region, especially its influence on the dynamics of each basin (subsidence and uplift) and its associated landscape evolution (hinterland uplift, palaeodrainage, sediment supply and input). This, in turn, defines palaeogeography, which provides an essential constraint for understanding source rock, reservoir and seal distribution and quality.

Key issues we are attempting to address:

- How influential are pre-existing basement fabrics on rift geometry, both onshore (Fig. 3) and offshore (Fig. 4)?
- What are the most prominent trends, where are they and how far do they extend?
- Do they influence cover fault development and sediment transport pathways?

- How does climate and tectonic evolution affect lacustrine source rock distribution and quality?
- Do the Pattani and Malay basins represent a distinct tectonic domain compared to the Western Thai Intra-cratonic Rift Province to the west?
- What is the structural configuration of the Khorat Plateau Basin (Fig. 5)?
- What was the course of the palaeo-Chao Phraya during the Neogene and what can this tell us about potential reservoirs?

Figure 3. Datasets used to define the location and geometry of the onshore Tertiary intra-cratonic rift basins in Thailand (mauve), and the position and influence of pre-rift basement fabrics.

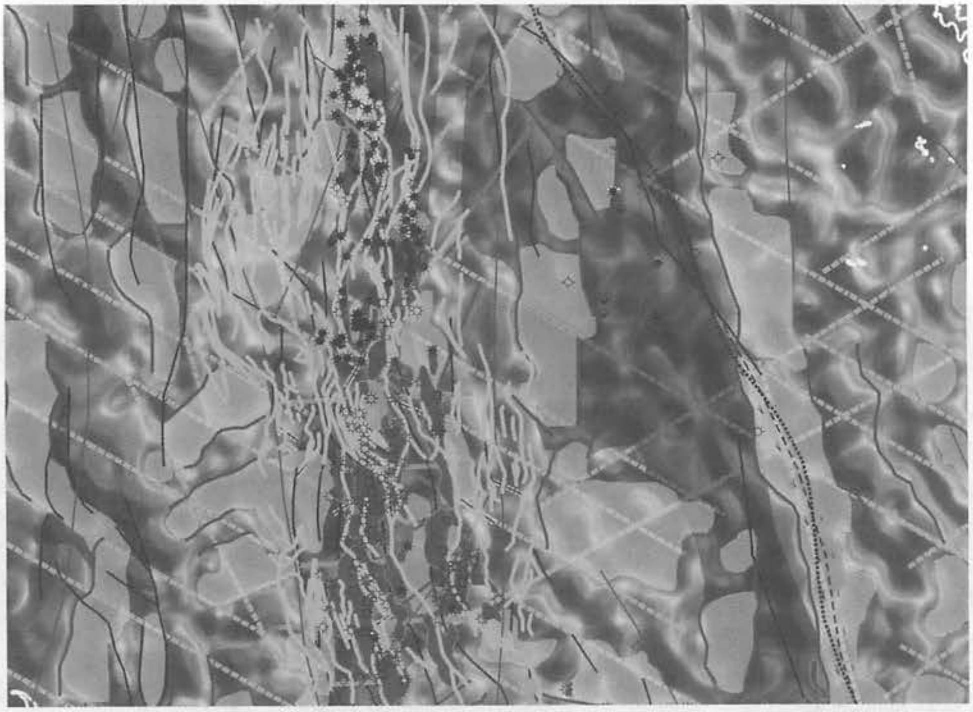


Figure 4. GETECH's 'Ultimate' gravity data used to define the location and geometry of the offshore Tertiary intra-cratonic rift basins in Gulf of Thailand (light blue), the position and influence of basement structures on post-rift faulting, and the occurrence of hydrocarbons.

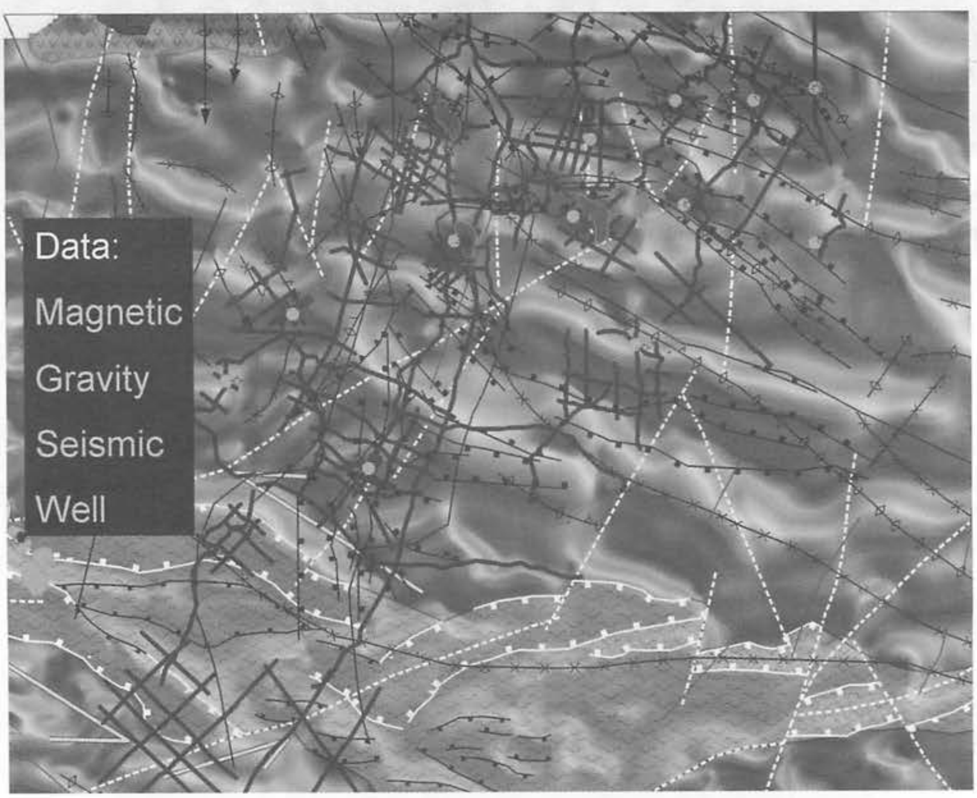


Figure 5. Datasets used to define the structural framework of the Khorat Plateau Basin.

Poster 2

An Integrated Approach on Carbonate Reservoir Evaluation by Combining Borehole Image and NMR Logs - A Case study in Ordovician carbonate, East China

Hou Huijun[1] and Yun Huayun[2]

[1] Schlumberger DCS, Beijing
[2] Shengli Oil Co. SinoPEC

Carbonate reservoir can always be extremely challenging for reservoir characterization due to its complex pore textures. It is often composed of a dual-pore medium system of fractures and pores. The different combinations and distributions fractures and pores cause severe heterogeneity in reservoir distribution and permeability.

This paper is a case study in an Ordovician carbonate, east China. Most carbonates are buried hill of Ordovician age and the reservoirs are dolomitized. Fractures are very important here as the porosity is often very low (about 2-5%). But sometimes the higher fractured zone may not be the higher production zone. So the two important things that one should be concerned with are (i) how to find the fracturedl zones, and (ii) the factors influenced the production rates.

An integrated approach using a combination of borehole image and NMR logs is applied for this carbonate reservoir study. Structure profile across the well, fracture and vug features, lithology, rock textures, pore textures and relative permeability are extracted carefully from borehole image and NMR logs. Furthermore, three different types of fractures are distinguished from borehole images by integration with other openhole logs. The relationships between these parameters are analyzed, and the reservoir types are classified in details, and the controlling factors of the reservoirs are summarized (Fig. 1). The results are validated with the well production rates.

1. Dip classification

The high resolution borehole images provide a good picture on different geological phenomena like fracture, fault, bed boundary, etc. Five kinds of dips are identified and represented with different colors in this study (Table 1). To thoroughly understand the reservoir characters, three different types of fractures are distinguished, namely, induced fracture, partly-filled conductive fracture, and resistive fracture. The partly-filled conductive fractures are considered as the most effective fractures.

2. Cross-well structure profile

Normally three factors influence carbonate reservoir. Lithology and primary pore properties are more related with sedimentary environment, such as porous grainy bio-debris mount or tight micrite. Diagenesis will destroy primary pores or form secondary pores, and post-structural active will contribute to growth of fractures or vugs by faulting or karst. The cross-well structure profile will be helpful for fracture study. Bed boundaries are used for structural re-construction in this study. One normal fault was found across the well near X150 meter, and lots of minor fault planes are associated with it. Within 50 m to the upper and around 120 m to the lower, fractures and dissolved pores are developed (Fig. 1). Most of the fractures strike along fault direction, and the rocks are strongly dolomitized over the interval. Therefore, it is considered that there was significant enhancement of reservoir properties by the fault.

3. Fracture analysis

As mentioned above, fractures are classified into three groups. Most drilling induced fractures were caused by the drilling vibration and have limited extension. Therefore, they have little effect on permeability although they looked conductive, and similar to the resistive fractures. Conductive fractures are the main contributors for the permeability although they are partly filled. The fracture properties such as the corrected fracture density (FVDC), the fracture trace length (FVTL), the mean hydraulic aperture (FVAH), and the fracture porosity (FVPA) can be provided ideally with image interpretation, and are used for integrated analysis. It was found that with similar FVDC, the FVAH in the dissolved dolomite is around 5 times larger than that in the tight limestone (Fig. 1). Fractures are abundant in the metamorphic rock basement, but these are deemed as joints that were opened by pressure release when drilling, and contributed little to production. Dissolution plays an important role for reservoir improvement.

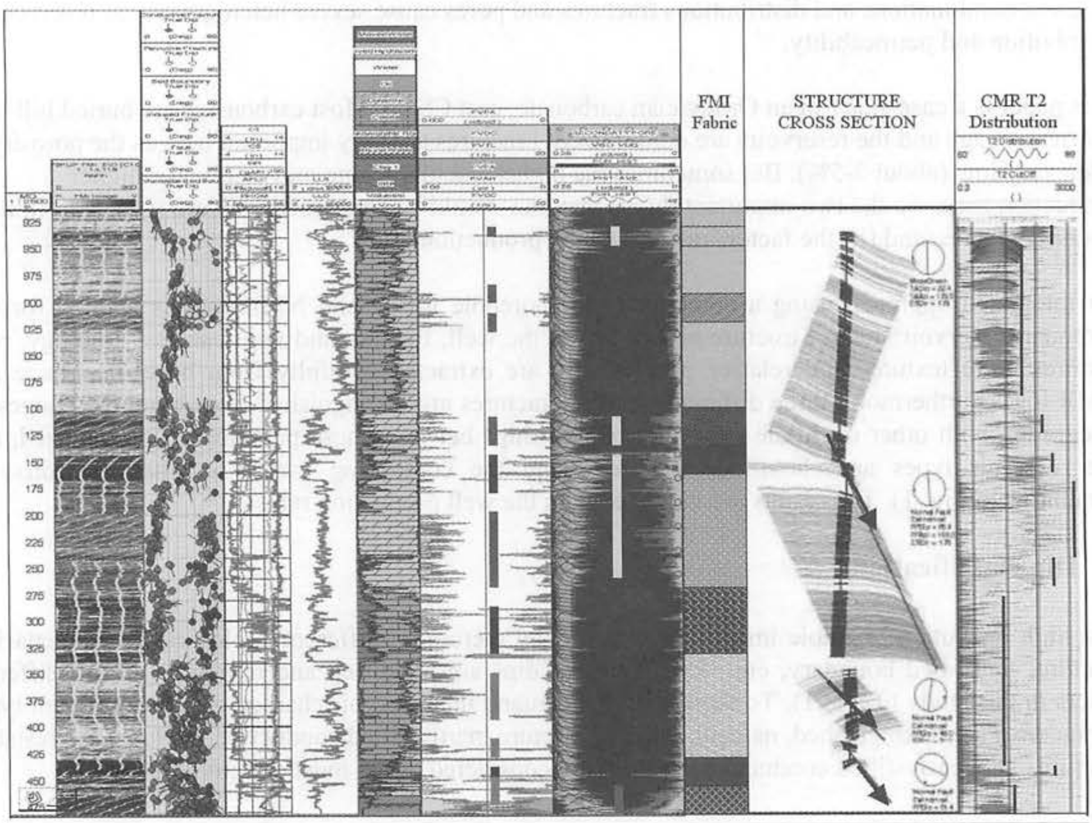


Figure 1. Integrated plot of reservoir features

4. Rock texture classification

Rock texture classification is a morphic classification based on the image fabrics, and ElanPlus* results are also be referred for the integration of lithology. Nine types are identified (Table 2). Rock texture, lithology and pore texture information are integrated in this classification (Fig. 2), providing a practical guide for reservoir prediction.

Table 1. Dip Classification

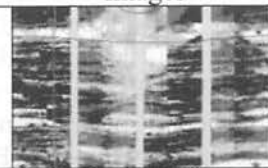
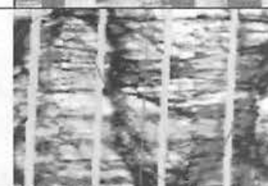
Type	Type	Index	Features	Images
I	Bed boundary	Green	Bed boundary to reflect regional structural formation dips and used for cross-well structure built up.	
II	Fault plane	Blue	Obvious fault planes or minor fault planes accompanied with main faults to indicate the fault zone and features. Offset beddings or truncation of beds can be visualized from the images. In many cases, interruption of dip patterns on the dip tadpole plot.	
III	Conductive fracture	Red	Natural open fractures or fractures filled with clay, which cut across the borehole appear on the unwrapped images as dark (conductive) sinusoidal anomalies due to the invasion of conductive drilling mud or clay.	
IV	Resistive fracture	Yellow	Fracture healed or cemented by resistive minerals that shows light color sinusoidal anomalies on images.	
V	Induced fracture	Pink	Drilling induced fractures are created by the drilling process or by a hydraulic frac. They do not cross the borehole normally and can be recognized on the FMI images by its echelon or symmetrical features.	

Table 2. Rock texture classification

No.	Type	Symbol	Perm(mD)	Structure
I	Metamorphics with pressure release joint fracture		<0.01	far
II	Massive marlite		<0.01	far
III	Laminated limestone with stylolites		<0.01	far
IV	Alternating Limestone and mudstone with deformed beddings		<0.01	Small fault
V	Dolomite(fracture)		0.3~0.5	Near fault
VI	Faulted shale/dolomite		0.05~0.3	Fault zone
VII	Dolomite Dissolved vugs		0.3~0.5	Near fault
VIII	Massive limestone		<0.01	far
IX	Laminated limestone		<0.01	far

5. Porosity distribution and pore size

Borehole images can be converted into porosity frequency distribution spectrum by using the Archie formula with the image that is scaled to the shallow lateral log. Applying a cutoff curve to discriminate between matrix pores and relatively larger pores through statistical analysis of pore distributions, it can be analyzed automatically. If there is only one peak on the frequency distribution spectrum, it shows that pores are developed relatively homogenously. However, the width of the peak reflects the heterogeneity with a wider peak indicating higher heterogeneity. The porosity distribution is plotted as similar as NMR spectrum and it is easy to compare them. In general, when the pores are filled with a single fluid, the NMR T2 distribution spectrum is considered to be related only to the pore size. The large size pores are mainly volume relaxation and surface relaxation and are reflected in the high side of T2 distribution spectrum, whereas small size pores are mainly surface relaxation and are on the low side of the T2 distribution spectrum. When there appear several pore sizes, multiple picks can be found on the distribution spectrum. By combined analysis of porosity frequency distribution spectrum and NMR T2 distribution spectrum, geoscientists can get a clear view on the heterogeneity of pores (Fig. 2).

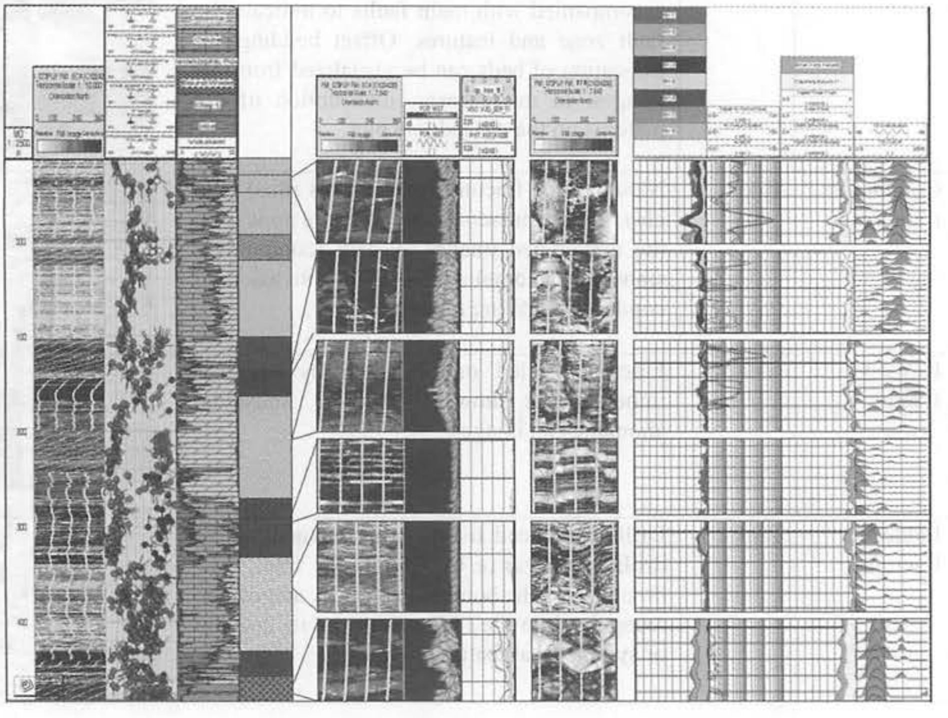


Figure 2. Rock features on Borehole image and NMR

6. Integrated analysis

The study found that the most productive zones are dolomite closely related to structure (near the fault zone), which contained the partly-filled conductive fractures and dissolved pores. It is also observed that if there are no dissolved pores, the porosity is less than 2% and most of them are matrix pores. In the dissolved zone, the matrix pore will also play an important role in some cases, because most of the fractures are partly filled and impaired their connectivity in some extent. If there is more matrix pore, the connectivity of fractures will be greatly enhanced, otherwise, the fractures may more likely be isolated vugs. This may be the case in the laminated limestone, where fractures were seen developed, but no production when testing. Another factor is related to clay contents. It is found that more clay contents near the fault zone caused pore sizes to decrease resulting in lower effective NMR permeability (Fig. 1).

This example demonstrated that, with FMI image and CMR information, an integrated study of the carbonate reservoir, combining the improved structure, fracture and vug features, pore texture and lithology, can provide a confident and unambiguous tool for reservoir evaluation and prediction.

Poster 3

Near-Real-Time Wellbore Completion Strategies in Complex Tectonic Settings to Optimize Target Drilling and Completion

Jürgen Streit[1], Wouter van der Zee[2], Katharine Burgdorff[1], Jon Rowse[3], Gavin Douglas[3]

[1] GeoMechanics International, Perth, Western Australia
[2] GeoMechanics International, Mainz, Germany
[3] Oil Search Limited, Sydney, New South Wales, Australia

Near-real-time geomechanical and sand production prediction modeling has significantly contributed to the decision-making process on appropriate completion strategies in current wellbores drilled within the Fold Belt structures in Papua New Guinea (PNG). The immense heterogeneity of the contemporary stresses, pore pressures, and rock strengths in the Fold Belt area of PNG require constant up-dating of geomechanical models while drilling to optimize target drilling and well completion.

In the SE Mananda block, the maximum horizontal stress (S_{Hmax}) orientation determined from image log analysis in two existing wells was found to rotate by up to 80° along hole in newly drilled wells. Therefore, known regional stress orientations cannot be reliably extrapolated to new targets. However, in the prevailing strike-slip stress regime ($S_{Hmax} > S_v > S_{hmin}$), accurate knowledge of the S_{Hmax} orientation is crucial for identifying optimum perforation orientations that avoid solids production from deviated wellbores with cased-perforated completion. In addition, knowledge of the reservoir rock strength is essential for the forward modeling of maximum sand-free drawdown during field depletion. Hence, near-real-time analysis of in-situ stresses and reservoir rock strength was applied.

The S_{Hmax} orientation in the reservoir was predicted from the immediate geomechanical analysis of image logs in the overburden section of the well and later verified by image log analysis in the reservoir sections. Reservoir rock strength was estimated from wireline and LWD data as they became available. Several empirical equations are applied to derive uniaxial compressive strength (UCS) from density (rho) and sonic (dt) logs. Rock strength and porosity calculated from different empirical equations are compared to laboratory-derived rock strength and measured porosity from offset wells. The distribution of UCS along the wellbore in the reservoir is estimated, and typically a P10 value is used for the modeling of sand production prediction. However, several rock strengths may be used to allow for flexibility in designing the completion.

Time-intensive finite element modeling was applied to predict the total plastic strain on perforations rotated at increasing angles around the wellbore. Figure 1 shows an example of such modeling. Perforation orientations with the lowest predicted total strain indicate the optimum perforation rotation (from top of the hole and for 180° phasing). The two curves in Figure 1 show that in this particular case, a 15° rotation of the S_{Hmax} orientation changes the optimum perforation orientation by approximately 25°. Thus much confidence in the S_{Hmax} orientation is required and can be obtained from image log analysis prior to completion.

The finite element modeling for sand production prediction is conducted for several planned drawdown scenarios. Modeling also incorporates planned pressure depletion to forecast the stability of perforations throughout the projected depletion history and associated stress path evolution of the field. The predicted total plastic strain on perforations typically increases with increasing drawdown and pressure depletion (Fig. 2).

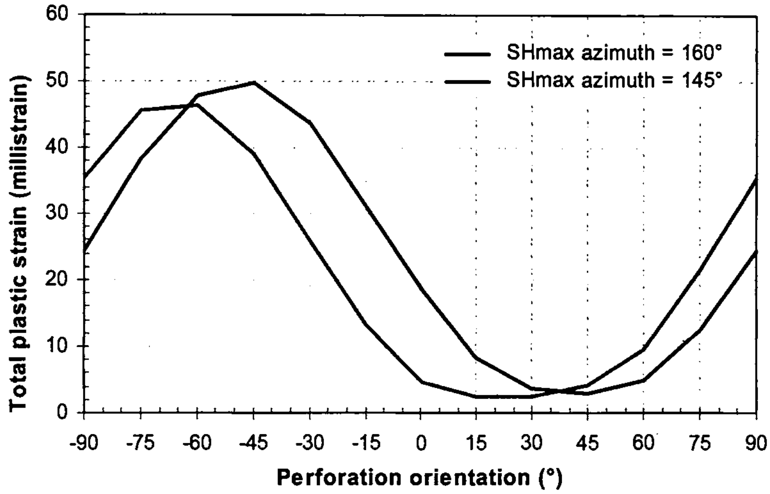


Figure 1. Predicted total plastic strain as a function of the perforation orientation in a deviated wellbore (deviation 45°; azimuth 123°) in a strike-slip stress regime at approximately 2150 m depth. The UCS is 4,800 psi. A change in the S_{Hmax} orientation from 145° to 160° changes the optimum perforation rotation from 15° - 30° to approximately 45° clockwise from the top of hole (top of hole = 0°). The example shown is for initial reservoir pressure and approximately 2000 psi drawdown.

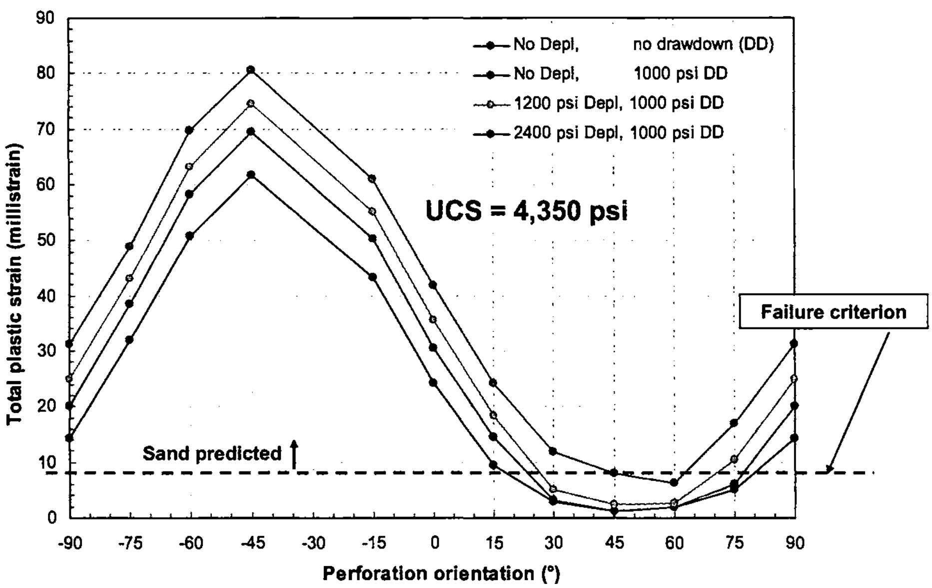


Figure 2. Predicted total plastic strain as function of perforation orientation in a deviated wellbore (deviation 30°; azimuth 097°) in a strike-slip stress regime at about 2200 m depth. S_{Hmax} azimuth is ~ 145°. UCS is 4,350 psi. Depletions and drawdowns shown are only example magnitudes of many cases modeled. Total plastic strain increases with increasing depletion of reservoir pressure and increasing drawdown. Sand production predicted to occur for strains above critical strain limit indicated by broken red line. Optimum perforation rotation of 45° clockwise from top of hole at initial pressure conditions (no depletion, no drawdown) changes to ~ 60° clockwise from top of hole at 2400 psi depletion and 1000 psi drawdown. (Top of hole = 0° and 180° phasing is assumed).

Depending on the well trajectory relative to the stress orientation, the optimum perforation rotation can change during field depletion and associated stress changes. Figure 2 shows the lowest plastic strain for a 45° clockwise rotated perforation at initial conditions, however, the optimum perforation orientation is 60° after 2400 psi depletion and 1000 psi drawdown. Figure 2 is only one example of a number of depletion and drawdown scenarios that were modeled. However, it illustrates that forward modeling of the effects of pressure depletion is essential for identifying the best perforation rotation that minimizes the risk of sand production.

Another reason for the forward modeling of the effects of pressure depletion is to determine whether production will be sand-free at a relatively high drawdown after pressure depletion (Fig. 2). The total plastic strain for maximum sand-free drawdown is calibrated from experience in offset wells or laboratory rock strength tests. In advanced thick wall cylinder tests, the spalling of sand grains from the rock is monitored and the corresponding total plastic strain is correlated with the onset of sand production. If field data are available, the calibration is typically based on the modeling of the total plastic strain that occurred in drill stem tests or production tests and correlated with sand production experienced.

The modeling of optimum perforation orientations and effect of drawdown is often conducted for several rock strength models. A comparison of Figures 2 and 3 shows that the higher rock strength in Figure 3 is associated with a much lower risk of sand production after pressure depletion. In addition, the higher rock strength model requires less precision when shooting the perforations

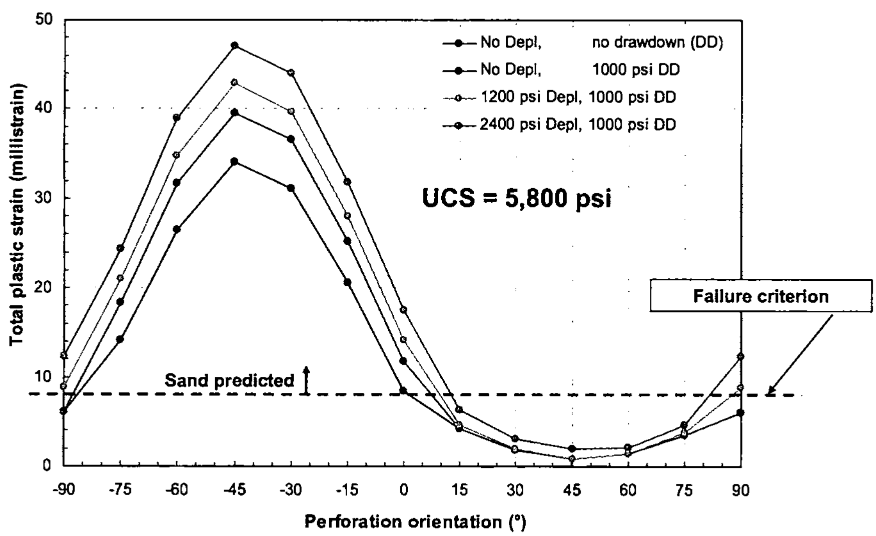


Figure 3. Predicted total plastic strain as function of perforation orientation in a deviated wellbore (deviation 30°; azimuth 097°) in a strike-slip stress regime at about 2200 m depth. S_{Hmax} azimuth is ~ 145°. UCS is 5,800 psi. Depletions and drawdowns shown are only example magnitudes of many cases modeled. In this scenario, perforation rotations of ~ 20° - 75° are predicted to be stable even after depletion of reservoir pressure by 2400 psi and 1000 psi drawdown. Thus, perforation of reservoir sections with relatively high rock strength can significantly reduce the risk of sand production. (Top of hole = 0° and 180° phasing is assumed).

because perforations in a relatively wide range of orientations (20° - 75°) are predicted to be stable. Thus, during the near-real-time log analysis, the determination of the rock strength distribution and associated uncertainties proves essential for identifying the most appropriate completion strategy. In some cases, sand-free production can only be achieved by perforating wellbore sections with relatively high rock strength.

Poster 4

Stress-Dependent Reservoir Properties

Li Qiuguo and Samie Lee

Schlumberger Data and Consulting Services, Kuala Lumpur

Reservoir porosity, compressibility and permeability are important parameters for evaluating reserves and developing optimum exploiting strategies. All these parameters are, to some extent, stress dependent. Since developing petroleum and natural gas reservoirs often involves massive changes in the state of stress, as well as pressure and saturation changes, it is important to understand the stress-dependent behaviour of these parameters, and incorporate it in to the reservoir management plan.

This paper describes how reservoir porosity, compressibility and permeability change with reservoir pressure and stresses, based on experimental and analytical results. A case study is given to show the significant effects of reservoir stress change on reservoir properties and performance, and the importance of coupling geomechanics and stress-dependent parameters in reservoir studies and reservoir development plan.

During the lifecycle of a field, reservoir pressure decreases with production and increases with injection. The pressure changes in the reservoir induce stress changes. The stress change coefficient, ratio of stress change to pore pressure change, varies between 0.2 and 0.8 in most reservoirs (Santarelli *et al.*, 1998), depending on the reservoir properties. The stress change coefficient can approach zero or one in some reservoirs. Temperature changes also induce stress changes in the reservoir, where heating (e.g., stream/hot water injection) increases reservoir stress, while cooling (e.g., cold water injection) decreases reservoir stress.

Stress changes in a reservoir can induce reservoir property changes, the reservoir properties that are affected by stress changes include porosity, compressibility, permeability, bulk density, resistivity, acoustic velocities, etc. Stress sensitivity of these reservoir properties have been analysed based on experimental results for decades, and most experiments show some extent of stress sensitivities in these properties.

Compressibility is the parameter that quantifies the relationship between the pressure exerted on a body and the resulting change in its volume. Pore volume and bulk volume and the porosity of reservoir rocks decreases under a certain range of confining pressures. The two commonly used compressibilities, bulk volume compressibility Cb, and pore volume compressibility Cp, can be related by Zimmerman (1991):

$$C_b = C_r + \phi C_p$$

where Cr is the compressibility of the rock matrix, ϕ is porosity. Bulk volume compressibility measured on various sandstone samples under different confining pressures (Fatt, 1958) shows the decreasing trend of the bulk volume compressibility (Fig. 1). Experimental data on Medina and Torped sandstones shows the decrease in pore compressibility with an increase in effective confining pressure (Dobrynin, 1962). It also shows a clear linear relationship between pore compressibility and logarithm of pressure within a certain effective confining pressure range (Fig. 2).

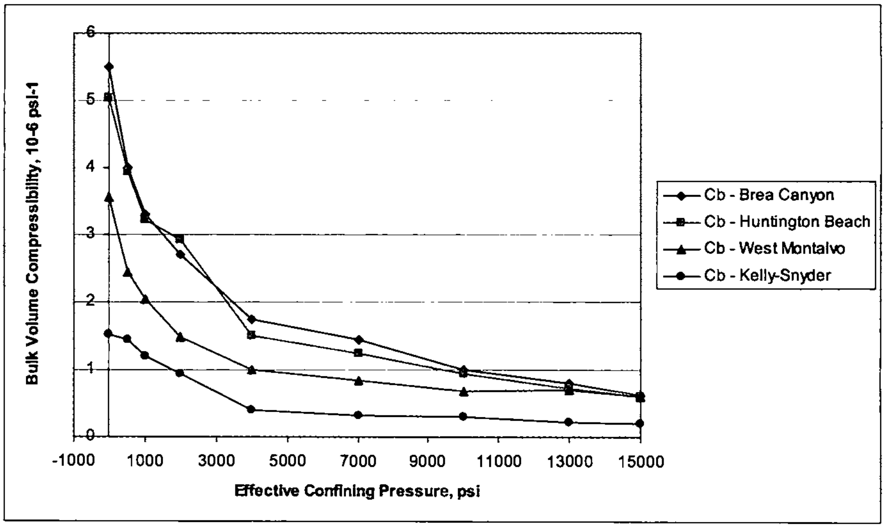


Figure 1. Bulk volume compressibility at different effective confining pressures (after Fatt, 1958).

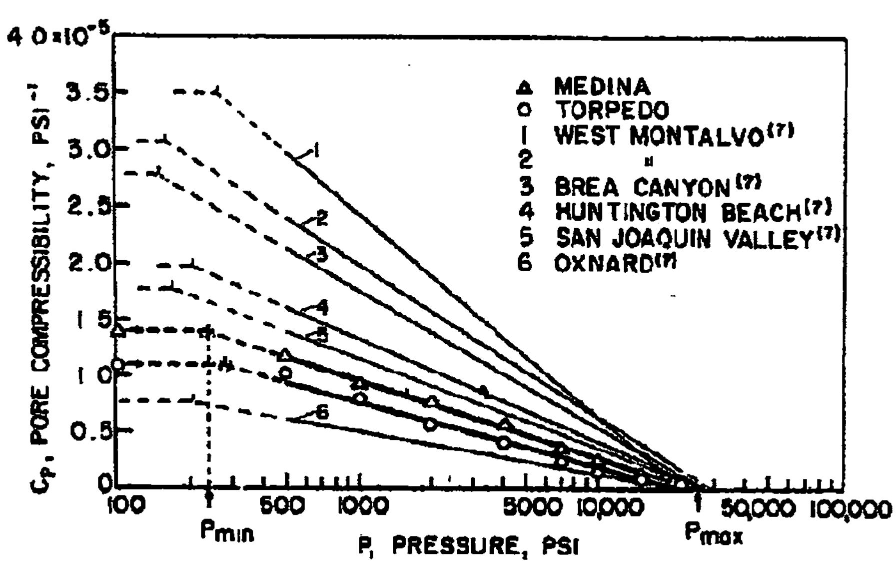


Figure 2. Pore compressibility at different effective confining pressures (after Dobrynin, 1962).

Numerous experiments were also conducted to evaluate the stress sensitivities of permeability (Vairogs *et al.*, 1971; Thomas & Ward, 1972; Jones & Owens, 1980; Ruistuen *et al.*, 1996; Al-Harthy *et al.*, 1998). Permeability generally decreases with increasing confining pressure, and it also varies with stress change coefficient (Ruistuen *et al.*, 1996; Al-Harthy *et al.*, 1998). Permeability reduction due to stress increase can be significant in some instances, especially for formations containing micro-fractures (Fig. 3).

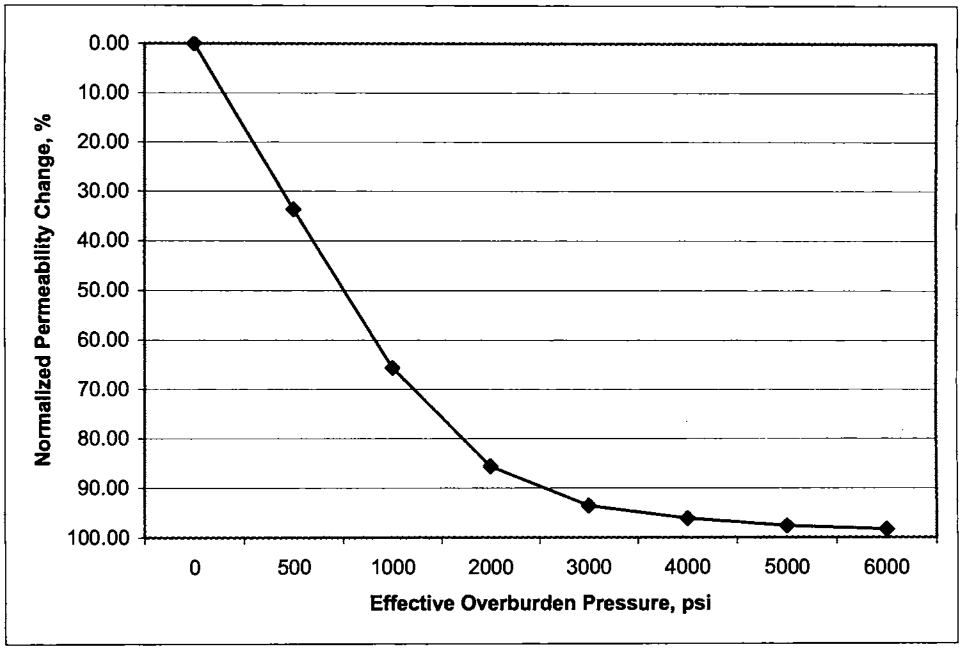


Figure 3. Normalized permeability change at different effective overburden pressures.

Analytic equations between reservoir property changes and effective stress help to understand how stress changes affect these properties. Many such equations have been developed, but care needs to be taken when trying to apply such equations to a specific reservoir. Based on Dobrynin's experimental data (Dobrynin, 1962), between a certain minimum effective confining pressure Pmin and a certain maximum effective confining pressure Pmax, the relationship between pore volume compressibility and logarithm of effective confining pressure can be approximated by a straight line (Fig. 2):

$$C_p = \frac{Cp^{\max}}{\log \frac{P_{\max}}{P_{\min}}} \log \frac{P_{\max}}{P}$$

where $Cp^{\max}$ is the maximum pore volume compressibility, which was determined by extrapolation of experimental curves to zero pressure.

The relationship between porosity change and effective confining pressure is:

$$\frac{\Delta \phi}{\phi} = 1 - \frac{1 - Cp^{\max} F(P)}{1 - \phi Cp^{\max} F(P)}$$

$$\text{where}, F(P) = P_{\min} + \frac{P}{\log \frac{P_{\max}}{P_{\min}}} [\log \frac{P_{\max}}{P} + 0.434 - \frac{P_{\min}}{P} (\log \frac{P_{\max}}{P_{\min}} + 0.434)]$$

The relationship between permeability change and effective confining pressure is:

$$\frac{\Delta K}{K} = 2(1+\gamma) \frac{Cp^{\max}}{\log \frac{P_{\max}}{P_{\min}}} P(\log \frac{P_{\max}}{P} + 0.434)$$

Changes in reservoir strata properties, as well as reservoir fluids, during production and injection have long been recognized. However, the reservoir strata typically have been considered to be static, partly due to the complexity of the process. Many field tests have demonstrated that the deliverability of the reservoirs is affected by stress changes and reservoir property changes as a result of stress changes. The sensitivity to changing stresses is most pronounced in tight, overpressured, naturally fractured reservoirs. From last decade, many people have been trying geomechanics coupled reservoir simulation to tackle this problem (Osorio, Chen & Teufel, 1997; Stone *et al.*, 2003).

Below is a case study, where we run a reservoir simulation model without geomechanics coupling and with geomechanics coupling using Eclipse 300*. The aim is to analyse the impact of geomechanics and stress-dependent properties on reservoir simulation results.

The dimension of the reservoir simulation model is 24 x 25 x 15, the permeability ranges from 5 mD to 20 mD. There are 26 producers and 2 injectors in the model. Figure 4 shows the geometry and the initial permeability distribution of the model. The model was run the first time without coupling geomechanics, subsequently the model was run again with geomechanics coupling. The main geomechanics parameters included in the model are: Young's modulus, Poisson's ratio, and stress-dependent permeability multipliers, where the permeability changing behaviour with various stresses is similar to that shown in Figure 3. The geomechanics modeling assumes elastic rock behaviour, and the coupling method is partial.

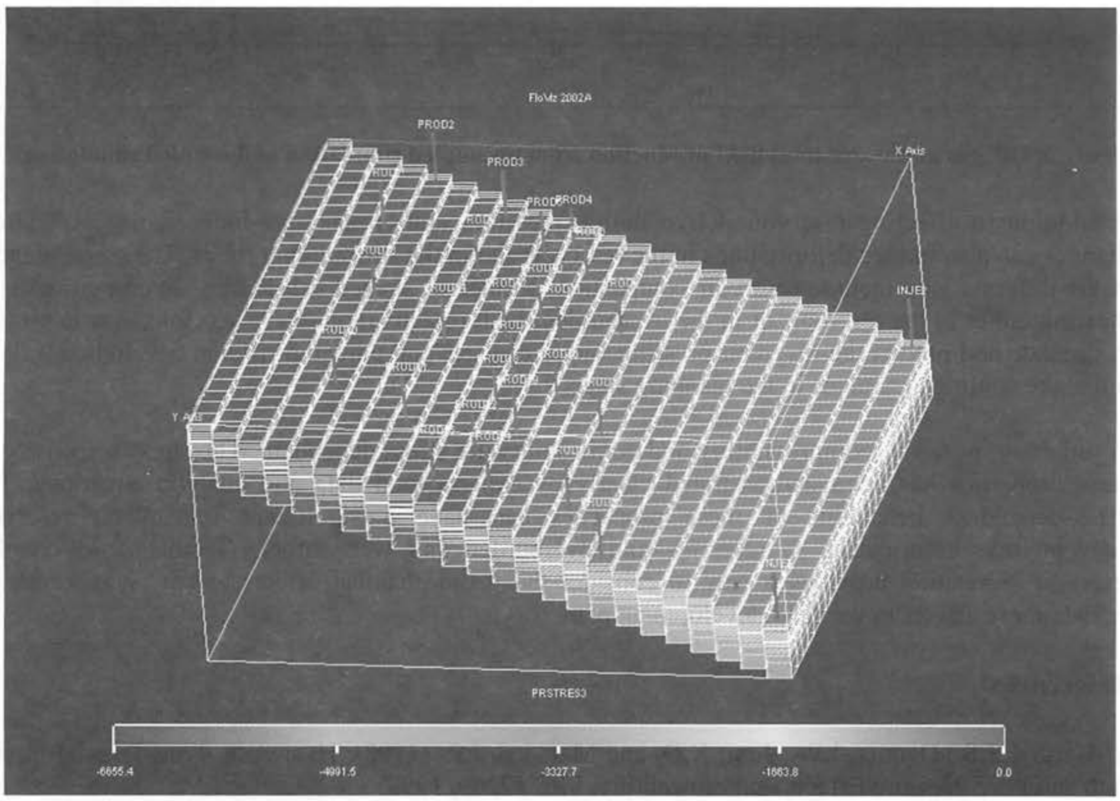


Figure 4. The reservoir simulation model and the initial permeability distribution.

Figure 5 shows the comparison of oil, gas and water total production between the two runs. In the figure, NOPERMS3_E300 is the run without geomechanics coupling, and PERMSENS3_E300 is the run with geomechanics coupling. FOPT is field production total, FGPT is field gas production total and FWPT is field water production total. It is clearly shown that the total production, especially gas and oil, is much lower if geomechanics and the stress-dependent effect are included. At the end of the 20-year production and depletion, oil production has decreased by 12%, and gas production has decreased by 33%.

* Mark of Schlumberger

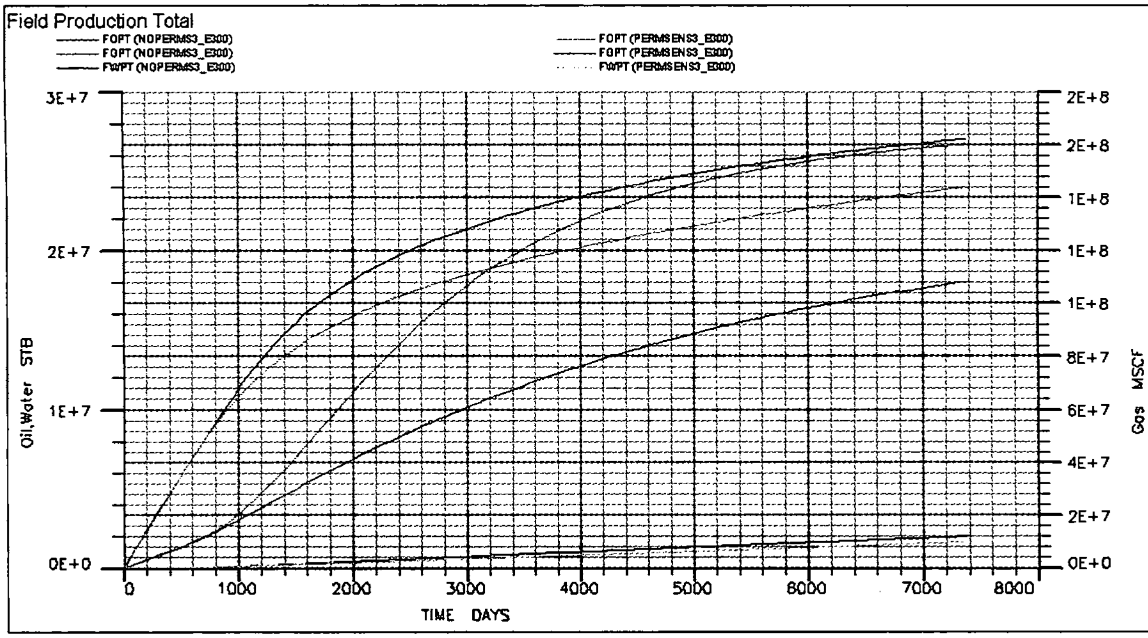


Figure 5. Oil, gas and water total field production from uncoupled simulation and coupled simulation.

In addition to affecting reservoir deliverability, pressure- and temperature-induced reservoir stress changes can also induce deformations in the reservoir and in the surrounding rocks. The consequences of the deformations include reservoir compaction, surface or seabed subsidence, casing collapse or shearing either in the reservoir or in the overburden, fault re-activation, etc. Therefore, it is important to simulate and predict the reservoir pressure, stress changes and potential risks in developing a field, and make contingency plans in the planning stage.

In summary, porosity, compressibility and permeability are stress dependent. The stress sensitivity of these properties has been demonstrated clearly by experimental data and analytic equations. The stress-dependent behaviour of these properties can have a significant impact on reservoir deliverability, deformation in reservoir and overburden and well safety. Geomechanics-coupled reservoir simulation provides a way to consider the geomechanical effects and it is important to include these effects in the field development plan.

References

Al-Harthy, S.S., Dennis, J.W., Jing, X.D. and Marsden, J.R. (1998): Hysteresis True-Triaxial Stress-Path and Pore Pressure Effects on Permeability. SPE 47269, 1998.

Andersen, M.A. (1988): Predicting Reservoir-Condition PV Compressibility From Hydrostatic-Stress Laboratory Data. SPE Res Engineering (Aug. 1988).

Dobrynin, V.M. (1962): Effect of Overburden Pressure on Some Properties of Sandstones. SPE 461, 1962.

Fatt, I. (1958): Compressibility of Sandstones. AAPG Bulletin, vol. 42.

Jones, F.O. and Owens, W.W. (1980): A Laboratory Study of Low-Permeability Gas Sands. SPE 7551, 1980.

Osorio, J.G., Chen, H.Y. and Teufel, L.W. (1997): Numerical Simulation of Coupled Fluid-Flow-Geomechanical Behavior of Tight Gas Reservoirs with Stress Sensitive permeability. SPE 39055, 1997.

Santarelli, F.J. *et al.* (1998): Reservoir Stress Path: The Depletion and the Rebound. SPE 47350, 1998.

Stone, T. *et al.* (2003): Coupled GM simulation of stress dependent reservoirs. SPE 79697, 2003.

Thomas, R.D. and Ward, D.C. (1972): Effect of Overburden Pressure and Water Saturation on Gas Permeability of Tight Sandstone Cores. J. Pet. Tech. (Feb 1972), 120-124.
Ruistuen, H., Teufel, L.W. and Rhett, D. (1996): Influence of Reservoir Stress Path on Deformation and Permeability of Weakly Cemented Sandstone Reservoirs. SPE 36535, 1996.
Vairogs, J., Hearn, C.L., Dareing, D.W. and Rhoades, V.W. (1971): Effect of Rock Stress on Gas Production From Low-Permeability Reservoirs. J. Pet. Tech (Sept., 1971,) 1161-1167.
Zimmerman, R.W. (1991): Compressibility of Sandstones. Elsevier Science Publishers B.V., 1991.

Poster 5

Geographic Text Search – A new approach to Information Discovery

J.P. Mazzaferro

MetaCarta, Inc., Houston, TX

New ventures, regulatory compliance, competitive intelligence and risk management are some of the drivers leading organizations to demand better tools for information discovery and analysis. The costly investments needed to build reserves utilizing the rapidly declining workforce demands further adoption of new technology. Innovative technology has always played a key role in making knowledge workers more productive by reducing workflow cycle time and improving reservoir prediction accuracy. Traditional search mechanisms are not enough to solve the problem of aggregating information sources and making a corporation's knowledge available for search and analysis from a common interface.

This paper discusses the challenges knowledge workers face in searching for information within an organization, the solutions traditionally used to find what they are looking for and a detailed look at a new approach, geographic text search, and the benefits that can be derived by using this technology.

Information Discovery Challenge

For years the industry has invested heavily in the management, visualization and analysis of highly structured data. Complex software and visualization tools are readily available enabling geoscientists to integrate, share and discover information and interpretations about complex reservoirs utilizing this structured data.

However, not all data within an enterprise exists in a structured database. Energy companies annually invest billions of dollars gathering and processing data contained within documents. These documents include critical information that drives important decisions made by company executives. As the energy industry expands its search for new oil and gas in more difficult operating locations access to pertinent information is critical. Future success will rely on utilizing hidden information and value found within the vast amount of unstructured data that is available.

Therein lies the challenge to knowledge workers and companies. Unstructured data is growing exponentially each year and many organizations are finding the management of unstructured data to be one of their most critical organizational challenges. Several documented studies have shown a significant percentage of a professional's time is spent searching for and reformatting data. The National Academy of Science found that:

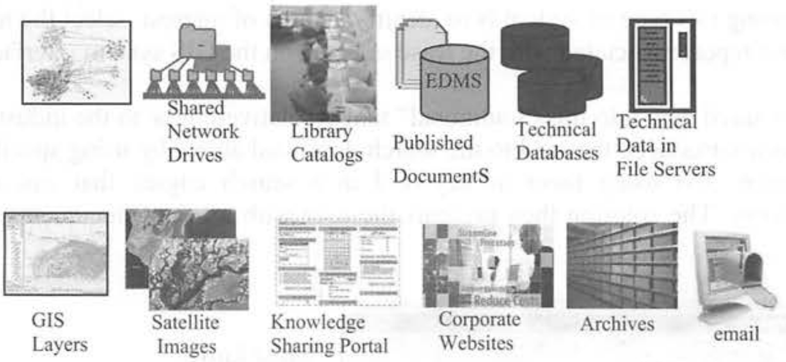
- 80% of all company data is in unstructured form,
- 80% of all decision making is based on these data (PowerPoint, Excel, Word, etc.),
- 85% of these data have geographical context within them.

IDC attempted to put a dollar value to the situation in a report entitled, "The High Cost of Not Finding Information," which demonstrated that an enterprise can lose millions annually in intellectual re-work, and time spent searching for non-existent data and failing to find existing information.

Content Sources

The advent of the web, distributed computing and the global nature of the energy industry has increased not only the amount of content available but also the number of places that must be searched. The diversity in where information can be found within an organization and external to the organization can be overwhelming at best. Illustrated below are some of the sources available within a typical Oil and Gas organization. Any one of these sources may be examined daily as the knowledge worker tries to find that one piece of information he needs.

Internal Sources



In addition to the many internal sources available there are just as many public and 3rd party sources. External sources, examples shown below, are used quite often as they offer not only a starting point but also when combined with each other a method of cross checking information. However, the availability, quantity and quality greatly influence the choice of sources. These three attributes vary across the different external sources and the knowledge worker is forced to select those they are most comfortable with just as they do with internal soruces.

External Content

Traditional Search Mechanisms

Technologies are playing a key enabling role in finding the gems of information that are located in different locations and formats. However, changes in infrastructure, applications used and web technologies over the last decade have outpaced the technology used to search for information. As a result, millions have been spent on maintaining, using, and trying to weave together various systems and sources of information. There are a number of tools available today to assist knowledge workers in locating information. Each of these has strengths and weaknesses.

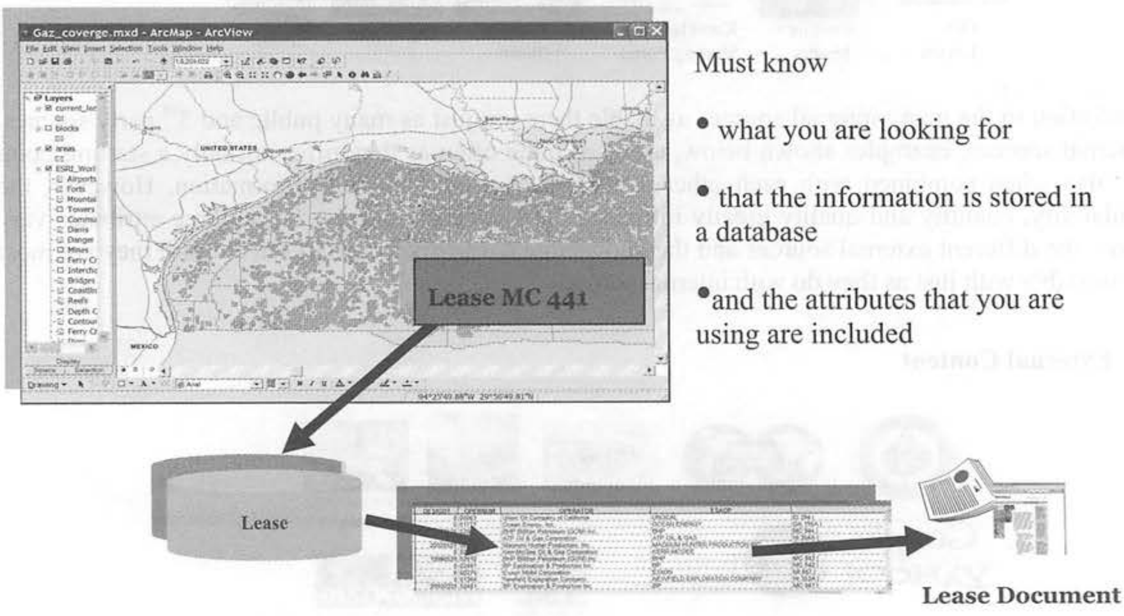
Shared Drive Search requires extensive knowledge of the drive structure and manual navigation. It is optimized for one taxonomy, to organize thousands of files. Users usually give up trying to find what they were looking for.

Text Search is a tool used every day by most internet-savvy users. It is generally fast, and brings multiple collections together in one space. However, it does not bring results into decision space, thousands of "best hits" are still too many to read, filtering on words alone is insufficient and it's time consuming to review. Additionally, general search engines are not tailored to the content an organization has access to. Rather it's tailored to the massive amount of information and relevancy algorithms used by the various search engines. The results of such a search often return items you aren't really interested in.

Spatial Searches

GIS systems have been used for many years to access structured information. A spatial search engine allows users to find information related to features on a map. This type of search begins with a map, layers of spatial data and attributes stored in a database to provide the foundation of the solution. A typical example of using this type of system is to identify an area of interest, select the lease layer and then retrieve the lease report associated with the lease selected on the GIS system interface.

Incorporating unstructured data into this "traditional" tool is relatively new to the industry. A number of solutions have been introduced that add to the search described above by using specified attributes of one or more layers and using them as keyword in a search engine that can search across unstructured data stores. The solution then presents the user with a list of documents that meet the criteria specified.



The use of this type of search is dependent upon the user being very familiar with the spatial data and related attributes in order to find information. That is, these tools depend on the user knowing what they are looking for, that the information is stored in a database and the attributes that are used are included and a search engine with access to unstructured data has been integrated together with the GIS system before results can be viewed. While this does assist in finding information in a new way it still requires the knowledge worker to be very familiar with the GIS system and the layers of data available just as they have in the past when looking for a specific production history report.

Data Fusion

Over the past five years most of the major and independent oil and gas companies have made large investments in the use of new technologies and techniques in an effort to better utilize semi-structured and unstructured information. Some of the tools used to assist in this data management challenge include:

- Mapping, Visualization, and GIS products
- Text and Document Search and Retrieval products
- Data and Knowledge Mgt products

Organizations that have utilized these technologies have realized some productivity gains. However, these systems are not typically integrated leaving a vast amount of information unavailable when working in any one system. While these existing systems address many needs, they fall short of pulling all of the information together in a common way. A mechanism is needed which enables data search and visual data fusion to increase the value of the existing technology and information management investment.

Geographic Text Search: A New Approach

Geographic Text Search (GTS) identifies implied and explicit references to geographic locations within documents; assigns latitude/longitude coordinates to the references, indexes the document, and then enables a search for indexed documents through Graphical User Interfaces (GUIs). Instead of starting from a map and related spatial databases and then finding documents, geographic text search starts with the documents and puts them on the map.

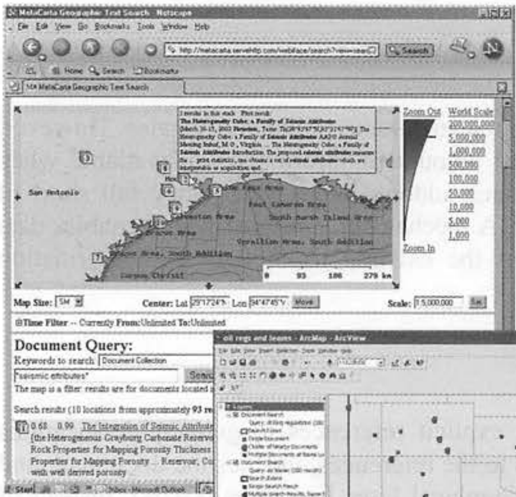
Natural Language Processing (NLP) is utilized by the solution to examine text strings and their context to determine whether "media," for example, refers to news media or to a place. If the latter, the system performs further context analysis to distinguish which of ten cities in the world named Media is intended.

Geographic Data Modules (GDMs), which are knowledge bases utilized to identify and disambiguate geographic references, assign latitude/longitude coordinates, and rank. The system currently consists of three such data modules:

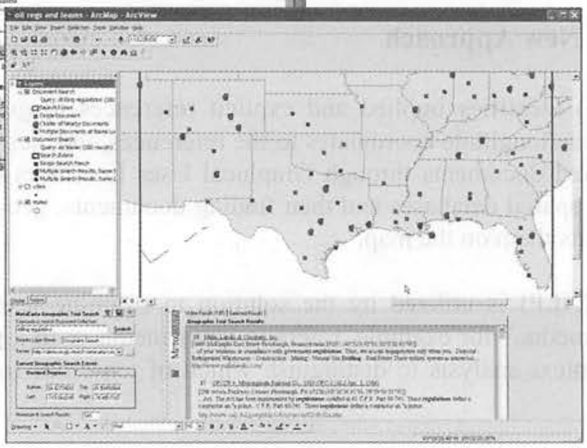
- Base GDM consisting of over 7 million know locations such as countries, cities, rivers, states, mountains and so on,
- Energy GDM that know about 3 million oil and gas related places, such as wells, leases and blocks which are found in publicly available sources such as the USGS and MMS,
- Custom Gazetteer allows organizations to include proprietary place names and location that are known only to them.

In summary, the processing engine of the solution extracts or computes the following items for each document:

- Geographic references, which may be place names or other forms of geographic annotation such as coordinates, military grid references, etc.,
- A latitude and longitude for each geographic reference,
- A GeoConfidence score for each geographic reference, which is the estimated probability that the assigned latitude and longitude are correct,
- An emphasis score for each geographic reference and each keyword reference, which is the estimated prominence of the reference in the document,
- The document's first recognized temporal reference.



Create a searchable index of geographic locations and key words contained within unstructured documents, located in disparate data sources



Puts documents on the map

The final step in the processing pipeline is indexing. The system builds specialized search indexes which allow documents to be rapidly retrieved in response to user queries that are some combination of geographic extent, keyword, and temporal factors. Geographic text search provides a platform for geospatial knowledge discovery. This tool enables users to bring together disparate sources of information into a common framework. The end-users are able to securely search across aggregated indexes of geo-referenced information from a single user interface.

Benefits

The ability to search for data, information, and knowledge across disparate document stores, sources, and the virtual organization for specific, geographically referenced information such as within field reports, legal documents, and or research literature can provide the differentiation needed in a very competitive world. Companies that embrace new technologies in today's information era will reap rewards well into the future.

Saving Time

One of the large international oil and gas companies that have implemented this solution has deployed it in two business units to help speed worker productivity. A manager in charge of the project there says the organization needed help in finding its own information:

"Trying to find what you thought was there used to be difficult. Our existing tools were not very good and none of them gave us spatial context. The geographic text search solution has given us far greater search speed and the ability to see search results in a map view. Additionally, it allows us to simultaneously search across our historical documents, internal Web pages and also our shared drive."

Significant ROI

Another international oil company conducted an internal evaluation which defined, tested and proved the business value proposition of Geographic Text Search:

- Savings of $4500/employee /annum via a conservative 1.5% estimate of realized time savings using this application.
- This translates to approximately $6 million per annum in manpower savings for just the business unit that participated in the study.

Enhanced Content Discovery

"80% of an international Oil and Gas companies' E&P data has a spatial component. Location, often on maps, is a natural way to organise and analyse information". Since the late 1990's this organization has tried to utilize the spatial component to structure data through manual geographic tagging, and searching to find information. The introduction of geographic text search has revolutionized this process through automation, and more "intelligent" querying. This technology matches how explorers think – in maps. By leveraging and integrating the strengths of these technologies users are rewarded with

- A simplified interface, on the web and desktop, with the same look-and-feel on the same indexes
- Aggregated indexes of internal and external data sources
- Better recall and precision based on geography, taxonomy, user-profiling and popularity/referrals
- Content quality control through partnerships between Information Management groups and Third parties

Summary

Geographic text search provides an enterprise the ability to

- Search multiple repositories connecting the documents throughout a company's enterprise
- Automatically process the unstructured documents to find references to locations within
- Secure documents at a file level
- Display the results spatially on a map
- Link back to the original document for viewing

Utilizing this technology allows users to discover and visualize new geographic relationships and trends, spend less time searching for information and have more time to make critical business decisions.

Reference

Enterprise Search Engine Technology Strikes Gold, Drew Robb, Datamation, April 10, 2003, http://itmanagement.earthweb.com/datbus/article.php/2184111

The High Cost of Not Finding Information, Susan Feldman and Chris Sherman, International DataCorporation, http://www.kmworld.com/publications/magazine/index.cfm?action=read article &Article_ID=1725&Publication_ID=108

BERITA-BERITA PERSATUAN (News of the Society)

Pertukaran Alamat (Change of Address)

1. Mohd. Farid Abu Bakar, Amerada Hess Malaysia S/B., Level 9, Menara Tan & Tan, 207, Jalan Tun Razak, 50400 Kuala Lumpur
2. Tajul Anuar Jamaluddin, 15, Jalan 8/32A, Seksyen 8, 43650 Bandar Baru Bangi

Current Address Wanted

1. Sham Shukriah Ab. Aziz

Pertambahan Baharu Perpustakaan (New Library Additions)

New Library additions

1. Nature and Human Activities, no. 10, 2006
2. Humans and Nature, no. 16, 2006
3. Natural History Research, vol. 8:2, 2005 & vol. 9:1, 2006
4. Journal of the Natural History Museum and Institute, Chiba, vol. 8:2, 2005 & vol. 9:1, 2006
5. Natural History Research, special issue no. 8, 2005
6. Berliner Palaobiologische Abhandlungen, band 6 & 7, 2005 & band 8, 2006
7. Public awareness of Science and Technology Malaysia 2004
8. AAPG Bulletin, vol. 89:11, 2005 & vol. 90: 5 & 6, 2006
9. Geosciences Journal, vol. 9, no. 4, 2005
10. Bulletin of the Geological Survey of Japan, vol. 56, nos. 3/4 and 5/6, 2005
11. Episodes, vol. 28, no. 3, 2005
12. Proceedings of the 34th Session, 2005
13. Malaysian Mining Industry, 2004

Proceedings for Sale

1. Forum on groundwater, 1994 (3 copies)
2. Forum on environmental geology & geotechnics, 1995 (4 copies)
3. Dynamic stratigraphy & tectonics of Peninsular Malaysia, 3rd seminar – the Mesozoic of Peninsular Malaysia (2 copies)
4. GSM-IEM forum: the roles of engineering geology and geotechnical engineering in construction works: proceedings (10 copies)

BERITA-BERITA LAIN (Other News)

NEW FREEWARE APPLICATION FOR MAKING TIME-STRATIGRAPHIC CHARTS

Contributed by Professor Emeritus Dr. Charles S. Hutchison.

Of interest to stratigraphers, paleontologists and others is a Java based, freeware application called TS-Creator, which can be downloaded from the International Commission of Stratigraphy's (ICS) web site: http://www.stratigraphy.org.

This application will allow you to generate detailed geochronologic charts that include stratigraphic markers such as fossils, geomagnetic polarity, and transgression/re-gression cycles. The charts generated are vector graphics, which you can save and import into drawing programs such as Adobe Illustrator.

To run this program, you will need Sun Microsystem's Java Runtime Environment (JRE). A review was published recently in Episodes (see reference, below).

References:
Ogg, J. and Gradstein, F. (2006) TS-Creator© - Chronostratigraphic database and visualization . Episodes 29, no. 1, pp. 65-66.

★★★★★

Note received on June 27, 2006

BERITA-BERITA LAIN (Other News)

Up Coming Events

Forthcoming activities

1. 15-17 August 2006: 31st Conference on OUR WORLD IN CONCRETE AND STRUCTURES – call for papers. Contact: Tel: 065 67332922; Fax: 065 62353530; Email: cipremie@singnet.com.sg

2. 6-10 September 2006: Engineering Geology for Tomorrow's Cities (10th IAEG International Congress), Nottingham, U.K. Contact: General inquiries: info@iaeg2006.com; specific inquiries related to the Technical Program: programme@iaeg2006.com; Website: www.iaeg2006.com/

3. **11-12 September 2006: Upstream Oil & Gas Congress 2006, Bangkok, Thailand. Contact: Helen Stokoe, Tel: 603 27236600; Fax: 603 27236699; Email: tanp@marcusevanskl.com. Event website: www.upstream-oilgas.com**

4. 9-13 October 2006: International Association of Hydrogeologists (34th International Congress), Beijing, China. Contact: Email: nizengshi@tom.com

5. 31 October-3 November 2007: Oil and Gas Technology Indonesia 2007: The 6th International Oil and Gas Exploration, Production and Refining Exhibition. Contact: Tel: 62 21 3162001; Fax: 62 21 3161983/4; Email: edy@pamerindo.com

6. 5-8 November 2006: 2006 AAPG International Conference and Exhibition: Reunite Gondwana – Realize the Potential, Perth, Australia. Contact: Tel: 1 781 821 6732; Fax: 1 781 821 6710; website: www.aapg.org/perth/.

7. 8-10 November 2006: Asian Rock Mechanics Symposium, "Rock Mechanics in Underground Construction" (4th International), Singapore. Contact: ARMS-4 Secretariat, Meeting Matters International, 5 Toh Tuck Link, Singapore 596224; Tel: +65 64665775; Fax: +65 64677667; Email: info@arms2006.org; Website: www.arms2006.org.

8. 3-5 December 2006: 2nd International Conference on PROBLEMATIC SOILS – call for papers. Contact: Tel: 065 67332922; Fax: 065 62353530; Email: cipremie@singnet.com.sg

9. 5-8 December 2006: OSEA 2006: The 16th International Oil & Gas Industry Exhibition & Conference, Singapore. Contact: Fax: 065 67326776; Email: events@sesallworld.com

10. 11-15 December 2006: THE GEOTECHNIQUE WEEK (deep foundations cum Piletalk, geosynthetics, soil nailing and anchors, slope stability, landslides and geotechnical engineering) – call for papers. Contact: Tel: 065 67332922; Fax: 065 62353530; Email: cipremie@singnet.com.sg

11. 3-8 June 2007: Landslides and Society (1st North American Conference), Vail, Colorado, USA. Contact: Dr. Keith Turner, Email: kturner@mines.edu; website: www.mines.edu/academic/geology/landslidevail2007.

12. 13-15 June 2007: OGA 2007: The 11th Asian Oil, Gas & Petrochemical Engineering Exhibition. Contact: Tel: 603 40410311; Fax: 603 40437241; Email: enquiry@mesallworld.com

13. 10-13 June 2007: Rapid Excavation and Tunneling Conference RETC 2007, Toronto, Canada. Contact: Tara Davis, SME, 8307 Shaffer Parkway, P.O. Box 277002, Littfleton, Co. 80127, USA. Tel: 1 303 973 9550; Fax: 1 303 973 3845; Email: davis@smenet.org; website: www.smenet.org.

14. July 2007: Rock Mechanics (11th Congress of the International Society of Rock Mechanics), Lisbon, Portugal. Contact: Sociedade Portuguesa de Geotecnia, LNEC, Av. Do Brasil, 101, 1700-066 Lisboa, Portugal; Tel: 351 218443321; Fax: 351 218443021; Email: spg@inec.pt; Website: www.isrm2007.org.

Advertorial

Upstream Oil & Gas Congress 2006

The **Upstream Oil & Gas Congress,** 11th & 12th September 2006, Bangkok brings you into direct contact with the major players, decision makers and operators in the offshore oil and gas sector throughout APAC, Middle East and Africa. Attracting those involved in the E& P activities, the **Upstream Oil & Gas Congress 2006** is a rendezvous point where best practices, ideas, technologies are shared.

Pressed by escalating oil demand and increasing portfolio of maturing fields, Oil and Gas operators are looking for ways to enhance productivity and arrest productivity declines of their fields. The congress targets this need, by focusing its theme on maximizing production and revitalizing mature fields.

Upstream Oil & Gas Congress 2006 brings together exhibition and a host of conferences. It is the ideal platform for gaining insights on best practices, ideas, solutions and technologies. Don't miss this chance in taking part in one of the most exciting gathering arena for the E & P industry in Asia Pacific.

Conference agenda and focus:

Upstream Oil & Gas Congress 2006 focuses on maximizing productivity, delaying production decline, and prolonging lifespan of mature fields.

The congress is structured into 6 comprehensive streams, presenting cutting-edge technologies and best practices:

- Drilling Best Practices and Technologies
- Reservoir Management and Engineering
- Production Optimization
- Well Technologies and Completions
- Improved Oil Recovery / Enhanced Oil Recovery (EOR/ IOR)
- Technology Management and Future Trends

Contact person: **Ms. Tan Peng Pheng**
Telephone: +603 2723 6614
Fax: +603 2723 6699
Email: TanP@marcusevanskl.com
Event website: http://www.upstream-oil-gas.com

GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATION

BULLETIN OF THE GEOLOGICAL SOCIETY OF MALAYSIA
WARTA GEOLOGI - Newsletter of the Geological Society of Malaysia

ADVERTISING SPACE ORDER FORM

	WARTA GEOLOGI Format : 20 cm x X 28cm		BULLETIN Format : 20cm x 28cm	
RATES	**Black & White**	**Colour**	**Black & White**	**Colour**
Inside full page per issue	RM300	RM600	RM1,000	RM1,500
Inside half page per issue	RM200	RM500	RM500	RM800
Inside full page for 6 issues	RM1,500	RM3,000	-	-
Inside half page for 6 issues	RM1,000	RM2,500	-	-

Artwork and positive films or slides (for colour or black and white) should be supplied by the advertisers

Please send the completed form below together with remittance payable to "Geological Society of Malaysia" to

The Editor
Geological Society of Malaysia
c/o Dept of Geology
University of Malaysia
50603 Kuala Lumpur, Malaysia

For further information, please call 603-7957 7036 or fax 603-7956 3900 or email to geologi@po.jaring.my

- -

The Editor
Geological Society of Malaysia
c/o Dept of Geology
University of Malaysia
50630 Kuala Lumpur

We would like to take up advertising space in WARTA GEOLOGI / BULLETIN in the form (Please tick as appropriate)

	WARTA GEOLOGI Black & White	Colour	BULLETIN Black & White	Colour
Inside full page	one issue ☐ six issues ☐	one issue ☐ six issues ☐	one issue ☐ ....issue ☐	one issue ☐ ....issue ☐
Inside full page	one issue ☐ six issues ☐	one issue ☐ six issues ☐	one issue ☐ ....issue ☐	one issue ☐ ....issue ☐

Artwork / Positive film/slide * enclosed ☐ not enclosed ☐

Company..
Address...
....

Enclosed cheque / money order / bank draft * .... for RM.................................
Person to be contacted...Tel..
Designation...Fax................................email..................................

*Please delete as appropriate.

Signature.................................

GEOLOGICAL SOCIETY OF MALAYSIA PUBLICATIONS

Bulletin 2 (Dec 1968). 152 p. Bibliography and Index of the Geology of West Malaysia and Singapore by D.J. Gobbett. Price: RM5.00 .
Bulletin 3 (Mar 1970). 146 p. Papers in Geomorphology and Stratigraphy (with Bibliography supplement). Edited by P.H. Stauffer. Price: RM5.00 .
Bulletin 4 (Jun 1971). 100 p. Papers in Petrology, Structure and Economic Geology. Edited by P.H. Stauffer. Price: RM5.00 .
Bulletin 5 (Feb 1973). 70 p. The Search for Tungsten Deposits by K.F.G. Hosking. Price: RM5.00 .
Bulletin 6 (Jul 1973). 334 p. Proceedings, Regional Conference on the Geology of Southeast Asia. A Collection of papers, Kuala Lumpur, March, 1972. Edited by B.K. Tan. Price: RM5.00 .
Bulletin 7 (Jun 1974). 138 p. A collection of papers on geology. Edited by B.K. Tan. Price RM5.00 .
Bulletin 13 (Dec 1980). 111 p. A collection of papers on geology of Malaysia and Thailand. Edited by G.H. Teh. Price RM5.00 .
Bulletin 17 (Dec 1984). 371 p. A collection of papers on geology. Edited by G.H. Teh. Price: RM10.00 .
Bulletin 18 (Nov 1985) 209 p. Special issue on Petroleum Geology. Edited by G.H. Teh. & S. Paramanathan. Price: RM15.00 .
Bulletins 19 (Apr 1986) & **20** (Aug 1986). GEOSEA V Proceedings Vols. 1 & 11. Fifth Regional Congress on Geology, Mineral and Energy Resources of SE Asia. Kuala Lumpur, 9-13 April 1984. Edited by G.H. Teh & S. Paramanathan. Price for both bulletins 19 & 20: Members: RM30.00: Non-members: RM60.00
Bulletin 21 (Dec 1987). 271 p. Special issue on Petroleum Geology Vol. 11. Edited by G.H. Teh. Price: RM20.00 .
Bulletin 22 (Dec 1988). 272 p. Special issue on Petroleum Geology Vol. 111. Edited by G.H. Teh. Price: RM20.00 .
Bulletin 23 (Aug 1989). 215 p. A collection of papers on the geology of Malaysia, Thailand and Burma. Edited by G.H. Teh. Price: RM10.00 .
Bulletin 24 (Oct 1989). 199 p. A collection of papers presented at GSM Annual Geological Conference 1987 & 1988. Edited by G.H. Teh. Price: RM10.00 .
Bulletin 25 (Dec 1989). 161 p. Special issue on Petroleum Geology Vol. IV. Edited by G.H. Teh. Price: RM20.00 .
Bulletin 26 (Apr 1990). 223 p. A collection of papers presented at GSM Annual Geological Conference 1989 and others. Edited by G.H. Teh. Price: RM10.00 .
Bulletin 27 (Nov 1990). 292 p. Special issue on Petroleum Geology Vol. V. Edited by G.H. Teh. Price: RM20.00 .
Bulletin 28 (Nov 1991). 292 p. Special issue on Petroleum Geology Vol. VI. Edited by G.H. Teh. Price: RM20.00 .
Bulletin 29 (Jul 1991). 255 p. A collection of papers presented at GSM Annual Geological Conference 1990 and others. Edited by G.H. Teh. Price: RM10.00
Bulletin 30 (Apr 1992). 90 p. Annotated bibliography of the geology of the South China Sea and adjacent parts of Borneo by N.S. Haile. Edited by G.H. Teh. Price: RM10.00 .
Bulletin 31 (Jul 1992). 176 p. A collection of papers presented at GSM Annual Geological Conference 1991 and others. Edited by G.H. Teh. Price: RM10.00 .
Bulletin 32 (Nov 1992). 283 p. Special issue on Petroleum Geology Vol. VII. Edited by G.H. Teh. Price: RM30.00 .
Bulletin 33 (Nov 1993). 419 p. Proceedings Symposium on Tectonic Framework and Energy Resources of the Western Margin of the Pacific Basin. Edited by G.H. Teh. Price: RM40.00 .
Bulletin 34 (Dec 1993). 181 p. Bibliography and Index – Publications of the Geological Society of Malaysia 1967-1993. Compiled by T.F. Ng. Edited by G.H. Teh. Price: RM20.00 .
Bulletin 36 (Dec 1994). 186 p. Special issue on Petroleum Geology Vol. VIII. Edited by G.H. Teh. Price: RM50.00 .
Bulletin 37 (Jul 1995). 506 p. Proceedings AAPG-GSM International Conference 1994. Southeast Asian Basins: Oil and Gas for the 21st Century. Edited by G.H. Teh. Price: RM60.00 .
Bulletin 38 (Dec 1995). 190 p. A collection of papers presented at GSM Annual Geological Conference 1994 and others. Edited by G.H. Teh. Price: RM30.00 .
Bulletin 39 (Jul 1996). 258 p. Papers from Petroleum Geology Conference 1995. Annual Geological Conference and others. Edited by G.H. Teh. Price: RM50.00
Bulletin 40 (Jul 1997). 247 p. A collection of papers presented at GSM Annual Geological Conference 1996 and others. Edited by G.H. Teh. Price: RM30.00 .
Bulletin 42 (Dec 1998). 268 p. Papers from Petroleum Geology Conference 1997, Seminar on Tertiary Basins of Peninsular Malaysia and others. Edited by G.H. Teh. Price: RM50.00 .
Bulletin 43 (Dec 1999). 698 p. Papers from GEOSEA '98 (Ninth Regional Congress on Geology, Mineral and Energy Resources of Southeast Asia). Edited by G.H. Teh. Price: RM70.00 .
Bulletin 44 (July 2000). 178 p. A collection of papers from Annual Geological Conference 1999. Western Belt & Paleozoic of Peninsular Malaysia Seminar 1999 & others. Edited by G.H. Teh. Price: RM30.00
Bulletin 45 (May 2002). 375 p. Annual Geological Conference 2002. Conference Issue. Edited by G.H.Teh, Ismail Yusoff, Azman Abdul Ghani & T.F. Ng. Price: RM50.00 .
Bulletin 46 (May 2003) 489 p. Annual Geological Conference 2003. Conference Issue. Edited by G.H. Teh, Alex Unya Ambun, Askury Abdul Kadir & T.F. Ng. Price: RM60.00 .
Bulletin 47 (Dec 2003). 179 p. Papers from Petroleum Geology Conference 2002, Petroleum Geology Conference 1999 and others. Edited by G.H. Teh. Price: RM60.00 .
Bulletin 48 (May 2004). 130 p. Annual Geological Conference 2004 Conference Issue. Edited by Lee Chai Peng, Mohd. Shafeea Leman, Joy J. Pereira & T.F. Ng. Price: RM30.00 .
Bulletin 51 (2005). 199 p. Annual Geological Conference 2005 Conference Issue. Edited by Nur Iskandar Taib. Price: RM30.00
Abstracts of papers (1972). Regional Conference on the Geology of Southeast Asia. Kuala Lumpur, 1972. 64 p. 8 figs. 3 tables, many extended abstracts. Edited by N.S. Haile. Price: RM2.00 .
Proceedings of the Workshop on Stratigraphic Correlation of Thailand Malaysia Vol. 1. (1983). 383 p. Technical Papers. Price: Member: RM5.00; Non-Member: RM15.00 .
Warta Geologi (Newsletter of the Geological Society of Malaysia). Price: RM5.00 per bimonthly issue from July 1966.
Geological Evolution of Southeast Asia (1996) (Reprinted Edition) by C. S. Hutchison. 368 p. Price: Member :RM50.00; Non-Member :RM100.00; Student :RM30.00 .
Common Rocks of Malaysia (Colour Poster). Price: Member: RM8.00; Non-Member: RM10.00; Student: RM7.00 .
Malaysian Stratigraphic Guide (Dec 1997). 30 p. Price: Member: RM5.00; Non-member :RM10.00; Student Member: RM2.00 .
Proceedings Annual Geological Conference 2000. 435 p. Edited by G.H. Teh, Joy J. Pereira and T.F. Ng. Price: RM60.00 .
Proceedings Annual Geological Conference 2001. 320 p. Edited by G.H. Teh, Mohd. Shafeea Leman and T.F. Ng. Price: RM50.00 .
CD-Rom & (Hard Copy 2 sheets & explanatory notes). Geology of Borneo Island (2001). Compiled by Robert B. Tate. Price: RM60.00 .
Stratigraphic Lexicon of Malaysia (2004). 162 p. Edited by Lee Chai Peng, Mohd. Shafeea Leman, Kamaludin Hassan, Bahari Md. Nasib & Roshidah Karim. Price: RM30.00 .

PACKAGE DEAL A: General Geology / Malaysian Geology
Bulletins 3, 4, 7, 17, 24, 26, 29, 31, 38 (9 books)
Member: RM50.00 — Student Member: RM30.00
Non-member: RM70.00 — Student Non-member: RM40.00

PACKAGE DEAL B: Bibliography
Bulletins 2, 30, 34 (3 books)
Member: RM20.00 — Student Member: RM10.00
Non-member: RM25.00 — Student Non-member: RM15.00

PACKAGE DEAL C: Southeast Asia
Bulletins 6, 13, 19 & 20, 23, 33, Strati. Correl (7 books)
Member: RM60.00 — Student Member: RM40.00
Non-member: RM100.00 — Student Non-member: RM50.00

PACKAGE DEAL D: Petroleum Geology
Bulletins 18, 21, 22, 25, 27, 28, 32 (7 books)
Member: RM120.00 — Student Member: RM80.00
Non-member: RM150.00 — Student Non-member: RM100.00

PACKAGE DEAL E: Economic Geology
Bulletins 5 (1 book)
Member: RM3.00 — Student Member: RM1.00
Non-member: RM8.00 — StudentNon-member: RM2.00

PACKAGE DEAL 1 : Bulletins 2, 3, 4, 5, 6, 7, 13 (7 books)
Member: RM30.00 — Student Member: RM15.00
Non-member: RM40.00 — Student Non-member: RM25.00

PACKAGE DEAL 2 : Bulletins 17, 18, 21, 22 (4 books)
Member: RM25.00 — Student Member: RM10.00
Non-member: RM35.00 — Student Non-member: RM20.00

PACKAGE DEAL 3 : Bulletins 19, 20, Strati Correl (3 books)
Member: RM30.00 — Student Member: RM20.00
Non-member: RM60.00 — Student Non-member: RM30.00

PACKAGE DEAL 4 : Bulletins 23, 24, 25, 26, 27 (5 books)
Member: RM40.00 — Student Member: RM20.00
Non-member: RM60.00 — Student Non-member: RM30.00

PACKAGE DEAL 5 : Bulletins 28, 29, 30, 31, 32 (5 books)
Member: RM40.00 — Student Member: RM20.00
Non-member: RM60.00 — Student Non-member: RM30.00

PACKAGE DEAL 6 : Bulletins 33, 34, 36, 37 (4 books)
Member: RM60.00 — Student Member: RM30.00
Non-member: RM100.00 — StudentNon-member: RM40.00

All prices quoted are not inclusive of postage. Please write in for details on postage. Allow 8-10 weeks for delivery. For orders, please write to the Society and you will be invoiced. Cheques, money orders and bank drafs must accompany all orders.

Orders should be addressed to:

The Hon. Assistant Secretary,
Geological Society of Malaysia,
c/o Dept. of Geology, University of Malaya,
50603 Kuala Lumpur, MALAYSIA
Tel: 603-79577036, Fax: 603-79563900, E-mail: geologi@po.jaring.my

Good old days of GSM and Department of Geology.................

Charles Hutchison, Prof Pichamuthu, students & staff by a good-looking minibus, University of Malaya in Singapore

Geologists having a good time at the New Year Eve party on 31 December 1971 hosted by Prof Hutchison : Denis Tan and Ghani holding the bar for Panchat Sivam to do the limbo..

Photo courtesy and caption : Prof Dr Wan Hasiah Abdullah, Head of Geology Department, University of Malaya

ISSN 0126-5539 PP2509/2/2007

WARTA GEOLOGI

Newsletter of the

PERSATUAN GEOLOGI MALAYSIA
Geological Society of Malaysia

Kandungan (Contents)

Jilid /Volume 32 No 3 May - June 2006