



AL HAJAR

Geological Society of Oman
Quarterly Newsletter

Sixth Edition

November 2005

The Feel Good Factor

On behalf of the Executive Committee, it is with great pleasure that I welcome our members to the 2005-2006 GSO calendar year. The Geological Society of Oman, since its inception, has been a Society of Professional and amateur Geoscientists in which membership and participation in GSO activities has always been entirely voluntary.

A short general definition of voluntary work is "that it is a sociocultural act in which the individual voluntarily and without pay participates in non-profitable activities in order to promote a good life for individuals or groups". I strongly believe that together we in the GSO are beginning to foster this sociocultural act amongst our members.

I say this because, it feels good when the GSO is contacted by speakers both local and international wanting to participate in our monthly talks. It feels good when fieldtrip leaders take the initiative to run fieldtrips for our members. It feels good when generous sponsors come forward in support of GSO. I believe that this surge in volunteerism is an acknowledgement of dedication and support towards the GSO.

I would like to thank GSO members who have paid their dues and remind those members who have not to do so. I would also like to thank our sponsors for their continuous support. Finally, I hope that you will participate and benefit from the upcoming GSO activities. It feels good.

Omar Al-Jaaidi
GSO President

Note from the Editor

Welcome to the 6th edition of Al Hajar. During the summer, GSO remained active and initiated a major new initiative regarding Oman's Geological Wonders based around eight themes. This is a unique and unconventional approach to promote Oman's geological heritage and Oman as a tourist destination. This initiative is introduced to the membership here and further details will appear in the next edition. In July GSO ran, for the second time, the Fundamentals of Geology course; reviewed in this issue by two of the participants. It is particularly pleasing to receive contributions from our younger members, so students, please share your research and thoughts with the wider Omani Geoscience community through this newsletter.

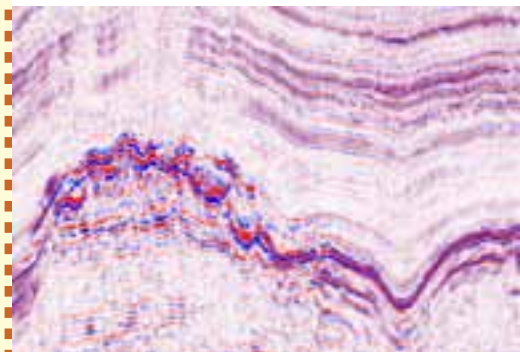
In this issue the MOG reports on new blocks open for exploration in the Sultanate. The 2005-2006 season has begun and included here is a review of the first field trip of the year as well as reviews of the last trips of the 2004-2005 season. Promotion of GeoTourism is ongoing and members of the Executive Committee attended an international conference in Germany in September, the outcome of which is reported. New to Al Hajar, we also have two book reviews in this issue.

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This issue is sponsored by



GEOLOGICAL WONDERS OF OMAN

Oman can be regarded as the world's best geopark with a rich and exotic heritage, containing magnificent geological features, structures and minerals. The beauty and value of Oman's geology has been acknowledged by internationally renowned academic institutions, geoscience students around the world and professional geoscientists. The GSO is organizing a world class marketing campaign and exhibition for Oman's Geological Wonders.



Eight Geo Wonders Themes have been developed by GSO to provide the tourism industry with a new angle for marketing and to provoke public curiosity to learn more about country's geological heritage. The eight wonders are:

1. Deserts of Oman.
2. Oman Fossils.
3. Semail Ophiolite.
4. Caves of Oman.
5. Oman Old Rocks (The Precambrian Huqf Supergroup).
6. Oman's Glacial Past.
7. The Oman Mountains Windows to Oman's Geological Heritage.
8. Salt Domes of Oman.

The unique and unconventional theme of eight Geo Wonders has never been used in the world before and it will help to position Oman as the best adventure and nature tourism destination in the region and strengthen its competitiveness in the tourist industry around the world.

The main objectives of the initiative are:

1. To increase the awareness and knowledge of both locals (nationals and expatriates) and Oman's visitors regarding Oman's rich geological heritage.
2. The use of geological sites to educate the public in terms of the geological sciences and environmental matters (geodiversity).
3. Promote Oman in the international arena as a leading destination for geotourism offering a spectrum of exotic and interesting localities.
4. To support the Omani Government global branding campaign "branding Oman" by promotion of geological wonders as one of the Sultanate's competitive advantages in the tourism sector.

These objectives will be met through:

1. The production of an exhibition to be held in Qurum Park during the 2006 Muscat Festival (17th January-21st February) that will showcase rock samples, dinosaur sculptures and a



DESERTS



FOSSILS



OPHIOLITES



CAVES

children’s activity area as well as portable panels highlighting the eight themes (see below). Additionally, the exhibition will be used at other events, with the support of Petroleum Development Oman and the Ministry of Tourism, including Geo2006 Exhibition and Conference (March 2006, Bahrain), ITB Berlin (March 2006, Berlin), Oil & Gas West Asia Exhibition and Conference (April, 2006, Muscat), Arabian Travel Market (May 2006, Dubai), Salalah Khareef Festival (July-September, 2006, Salalah). Muscat Festival (January, February 2007)

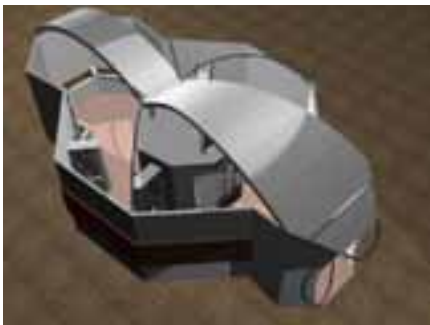
2. Geo Wonders booklet that will describe the geological history and setting of Oman in general and the Sultanate’s Geological Wonders.
3. Geological Wonders 2006 Calendar.
4. Educational posters that will be distributed freely to all major schools in Oman.

The advertising campaign, which will be accompanied by a Public Relations Campaign will commence in November to coincide with the nation’s celebration of the 35th National Day and the inauguration of the Al Huta Cave near Nizwa. The cave is Oman’s first geo-tourism project. A significant promotional schedule has been formulated to advertise the wonders in the media, including a fully dedicated web site.

An organization committee of talented geologists and marketing professional members of GSO has been established to manage the project. Mr Radha Al-Lawati has been appointed as Manager and Marketing Consultant of the project and Dr. Nadia Al-Abry will be the head of the Geo-Technical team. Sponsorship opportunities are available and interested parties should contact either of the above for a sponsorship package.

Geological Wonders of Oman and Theme Logos are Registered Trade Marks.

Various Views of Proposed Exhibition Design



New Blocks open up for exploration in Oman

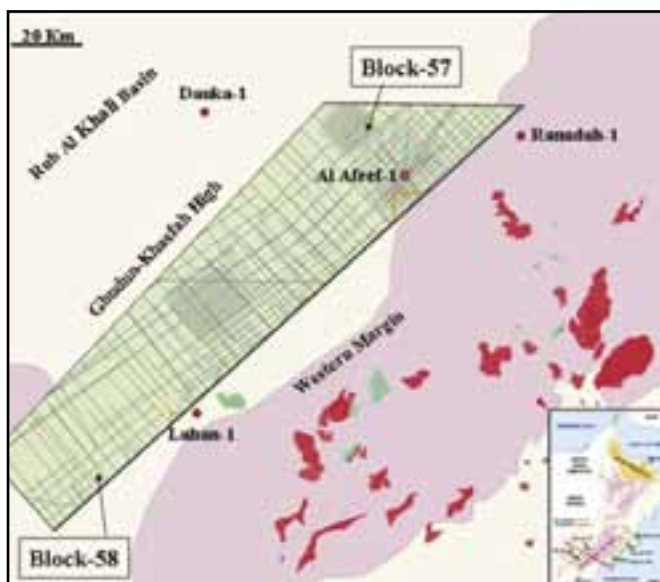
Adil R. Jaman (Ministry of Oil and Gas)

On behalf of the government of the Sultanate of Oman, the Ministry of Oil & Gas (MOG) is pleased to announce the availability of data packages for the newly relinquished areas from Petroleum Development Oman (PDO) block 6. The relinquished areas are divided into 5 blocks, three of them are located in the Eastern Flank (Blocks 54, 55, & 56), whereas the other two (Blocks 57 and 58) are situated along the Western Margin of the South Oman Salt Basin (Figures 1 & 2).

Eastern Flank Blocks 54, 55 and 56

The Eastern Flank blocks have a total area of 19000 km² and are situated along the flank of the prolific hydrocarbon bearing South Oman Salt Basin. Information from the existing seismic and well data strongly indicate extension of the South Oman Salt Basin play elements into the relinquished areas. Moreover, most of the wells drilled in the relinquished areas have hydrocarbon indications ranging from strong shows to proven net pay. On top of being directly adjacent to the Eastern Flank producing fields, the offered blocks are also close to the established pipeline infrastructure.

Eastern Flank Blocks 54, 55 and 56



Western Margin Blocks 57 and 58

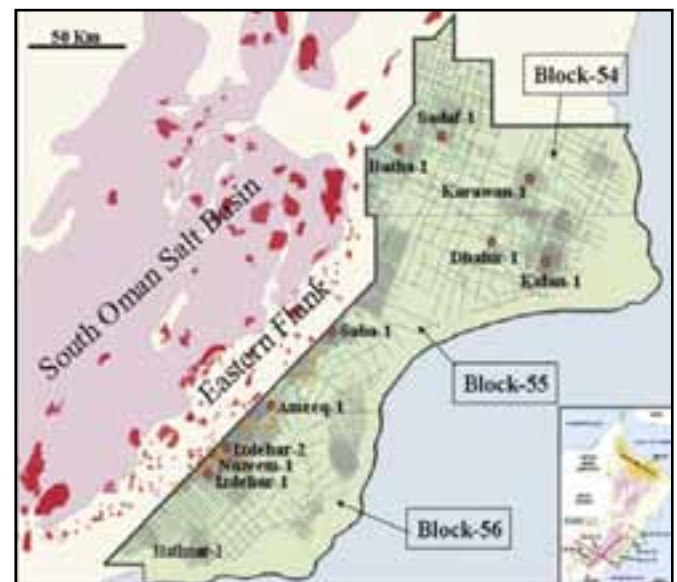
These blocks have a total area of 4545 km² located along the western flank of the South Oman Salt basin. Geologically, the two blocks are situated between the eastern pinch-out margin of the Rub Al Khali Basin fill above the Ghudun-Kasfah high and the highly structured Western margin of the South Oman Salt Basin. Therefore, a variety of play types and trapping styles are expected and waiting to be unraveled.

Summary

The Blocks offered are available to the public for the first time since 1937 as part of the PDO relinquishment to the government. Little focus was directed towards these blocks due to PDO manpower constrains, as such they were significantly under explored compared to elsewhere in block 6. The blocks are currently available in a bid round. Final offers are due on 1st January 2006.

Arjaman@mog.gov.om

Figure 2: Seismic Base Map Blocks 57&58



GSO Field Excursion through Jabal Akhdar and Saih Hatat 21-22 April 2005.

Contributors:

Mohammed Mazrui (PDO), Yousuf Al-Sinani (ResLab) and Paulo Bizzaro (PDO)

Excursion Leader: Jean-Paul Breton (BRGM Oman Branch)



Stratigraphic evolution and stratal geometries of the Cretaceous carbonate platform in Oman.

29th-30th September, 2005

Excursion Leader: Henk Droste (JVR Centre for Carbonate Studies, SQU)

Sponsored by:



“The work programme was intended to continue from the same camp, with the sampling of a second gorge, located just north of Birkat el Mauz village, It was here that Suleiman bin Hamyar, one of the more famous or infamous of Oman tribal leaders, lived in splendid isolation. The importance of the Birkat El Mauz section to the company was that it was the most complete section of exposed rocks which might give clues about what the bit might be expected to penetrate as it drilled deeper at Fahud....”

From Don Sheridan’s, 2000, Fahud, the Leopard Mountain, p. 140 describing a failed attempt to survey Wadi Mi’aidin in 1956.

The fort of Suleiman bin Hamyar still dominates the entrance of the wadi, but the early explorers in 1956 would probably have difficulties in imagining a splendid blacktop through the wadi only 50 years later.

The wadi indeed exposes what the first Fahud well penetrated and what later proved to be one of the main oil bearing reservoir successions in Oman. A time window of some whopping 150 million years, from Triassic to Upper Cretaceous, of mainly carbonate rocks, including the Shuaiba and Natih platform carbonates that home many of Oman’s oil fields.

“Platform carbonates” We heard these words many



The anticlines of the Salakh Arch, clearly visible from outer space, with Jabal Madmar in the lower middle.



Wadi Mi’aidin, Henk Droste pointing to the progradational Habshan Formation carbonates (top ridge) and associated slope carbonates of the Salil Formation (bottom ridge). Referring to the Cretaceous carbonate platform model in his

times during the 14th GSO field trip. After more than 12 years in Oman, Henk Droste has become THE carbonate expert and it was a real privilege to hear him explaining and pointing-out the finest details. The understanding of what these carbonate platforms were became very clear during the fieldtrip. Apparently layer-cake, but in reality complex low to high angle geometries and internal architectures relate to very different depositional environments, with a lot of differentiation in sub-platforms with



Alan Heward smelling the source rocks of the Natih E in Henk’s wadi at Jabal Madmar



lagoons, microbial mound reefs and deeper mud-filled sub-basins. Subtle angles that can hardly be observed at outcrop scale do really matter!

The explorers in 1956 had to return to a base camp near Izki, but we were booked in the luxurious Nizwa Hotel, hardly 5 km from the wadi. Our de-

briefing was quietly floating in the swimming pool. Good geology, good company and good food.

The rocks in Wadi Mi'aidin have been subjected to deep burial and deformation associated with the Late Cretaceous ophiolite obduction and young Tertiary deformations resulting in the Oman Mountains as we see them now. The carbonate rocks in Wadi Mi'aidin are therefore not directly comparable to the reservoir rocks from which the oil in the interior basins of Oman is produced. More comparable, in terms of reservoir properties, are the carbonate rocks that are exposed in the jabals of the Salakh Arch, near Adam. That's where Henk took us on the second day of the fieldtrip.

Many of us have seen these whalebacks, more like the last sentries of the Mountains before the vast flatness of the interior gravel desert of Oman. They



From Henk's valley in the northern side of Jabal Madmar to well Madmar-1 on the top

are true anticlines, arranged in a wide arch, the kind of things that geologist like to poke holes in as Thesinger already observed in the late 50's while traveling on camel through Oman. Jabal Madmar, dominating the horizon just east of Adam, has one of these holes, well Madmar-1, drilled by PDO in 1989-1990. It found a bit of gas in difficult Haima reservoir and that left the rest of the anticlines essentially untouched by an industry that was



focused mainly on oil. That is until geologists like Henk recognized their value as analogs for the deeper buried carbonate oil fields like

Fahud and Natih. The outcrops are near 100%, revealing not only the rocks, but also their systematic fractures and faults. Henk's wadi, cutting in the northern side of the Madmar anticline, provides a complete section though the older Natih depositional cycles. Again a lot of opportunity for close observation, even the sniffing of the Natih E source rocks, as well as wide scanning of the larger scale rock successions and geometries: platform carbonates are certainly not layer-cake.

The access road to the drill site of Madmar-1 is easily accessible, except for the dust clouds that the last car was suffering from, but hey, the view on top is great. If you want to appreciate the size of one of these anticlines there is nothing better but to stand on top and see the rocks dipping to all sides. A worthy place to end this fieldtrip.

Many thanks to ResLab, the sponsor of this fieldtrip and to Henk Droste for sharing his intimate knowledge of these rocks and to GSO for the excellent organization.

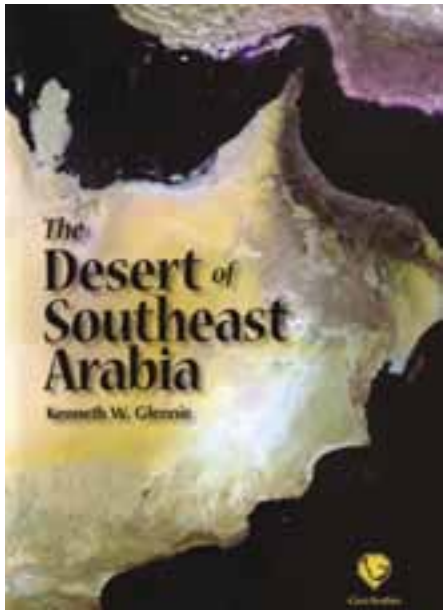


On top of Jabal Madmar GSO 14th fieldtrip, 30 September 2005

Somehow the participants of this fieldtrip were classified as those 'with beards' and those 'without beards', implying indirectly some deeper links to more detailed knowledge of respectively hard and soft rocks. There was also the French school and the rest of us, the Muti and the Fiqa..... Whatever, at the end of the days we all learned a lot about Oman's Cretaceous carbonates and with a great group of people that fixed Henk's flat tire in no time even after a long day in the field.

Jan Schreurs (PDO)

Book Review



The Ken Glennie book on the desert of South East Arabia, just published, is a very pictorial, field-orientated collection of insights and images about desert sediments. Ken has compiled this knowledge since he began his field work for Shell in the

Gulf region in 1965. Since those early days, he has invested much of his career in demonstrating the truth – and commercial value - of the old saying in geology that “the present is the key to the past”.

Ken’s groundbreaking recognition in 1972 that the Permian Rotliegend Sandstone of the North Sea consisted of a vast ancient desert dune-fluvial-sabkha system contributed materially to exploration and development success in that region. His interpretations were based substantially on his study of surface geomorphology and trenches in modern desert sediments from Oman and the United Arab Emirates. In fact, Ken’s trenches in dunes and wadis – many of which are shown in this volume, have been used extensively each time a significant new hydrocarbon play has appeared in desert sediments.

The Desert of South East Arabia

Gulf Petrolink. ISBN 99901-04-89-1

**An overview by Steve Fryberger
(condensed from the forward to the book)**

As a whole, this book is a valuable re-statement of the importance of physically looking at modern desert sediments and processes as a necessary first step to interpret the subtleties and complexities of ancient deserts now preserved in the geological record. This is because, despite the complications caused by shifting environments, it is still true that natural laws have applied consistently throughout time. For example, wind ripples will always form the same way in terms of the basic physics.

This book will serve as a reliable field guide to those students, teachers, oil industry professionals and even non-specialist travellers who wish to understand the desert terrains and processes of southeast Arabia. It will also serve as an inspiration to students and teachers in the Gulf region. It is true that the best science triggers more work because it opens possibilities not seen before. The great variety of ideas, and the beautiful photographs leave the reader with the lasting impression that Ken’s work should be carried further and that much remains to be done.



Book Review

Many of us unconsciously assume that Saudi Arabia's oil resources are as good as boundless and that it will long remain able to satisfy the world's thirst for petroleum. But should we? What happens when the huge fields that have fuelled the world for decades go into decline, as all fields do? Where do you go to make up a million or two barrels a day? These are questions that Matt Simmons, an Energy Investment Banker from Houston, sought answers to following a visit to the Kingdom in January 2003. He discovered that 90% of all the oil that Saudi Arabia has ever produced has come from just seven super-giant fields (Ghawar, Abqaiq, Safaniya, Berri, Zuluf, Marjan and Shaybah). The largest of these, Ghawar, still accounts for more than 50% of the flow. When he returned to the US, he downloaded hundreds of technical papers from the SPE online library to try to understand the character and health of the Kingdom's key fields.

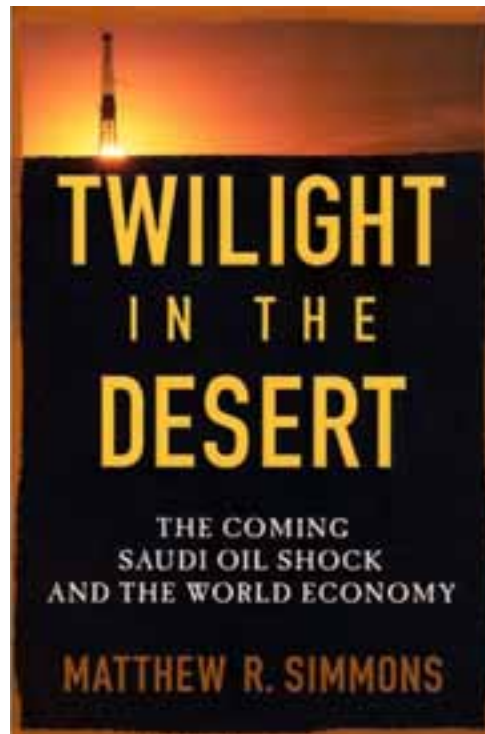
Part 1 of the book documents the ascendancy of Saudi Arabia to the position of the world's leading oil producer (9.5 million barrels a day in H1'05) and its swing producer. Part 2 provides an overview of the oil and gas industry, Saudi Aramco, and the challenges it faces as its major fields mature. Part 3 analyses each of the super-giant and giant fields in turn, the King, Queen and Lords of an oil basin in IFP parlance. It is revealing that much of Ghawar's prolific oil has come from the fabulously permeable Arab-D dolomites at the northern end of the field. Here the development wells are closest (Ain Dar, Shedgum and N Uthmaniyah). Much of the remaining potential lies in less permeable, more challenging, complex and oft-mothballed reservoirs at the southern end (S Uthmaniyah, Hawiyah and Haradh). How long can Ghawar's 5 million barrels a day of production be sustained? Each of the major fields is subject to several pages of analysis. He questions whether some new technology, like Maximum Reservoir Contact wells, are not just 'super-straws' that drain reservoirs quickly and for a time sustain production but add little to ultimate recovery? Rather perceptive for a banker and only time will prove the benefit or otherwise of such development options. Part 3 also

Twilight in the Desert

by **Matthew R. Simmons, 2005.**

John Wiley and Sons, Inc. ISBN 0-471-73876-X

discusses the modest success of extensive oil and gas exploration efforts over the past 35 years. There is no new Ghawar waiting in the wings and few undeveloped or mothballed fields with substantial, in Saudi terms, potential. There is a pressing need to discover huge volumes of gas to meet the electricity and water demands of a population that is expected to double in size to 30 million in the decade 2000 to 2010. Part 4 provides an assessment of possible hydrocarbon resources, provides comparisons with the published behaviour of giant oil fields in the US, N Sea, Iran, Oman (Yibal) and Siberia, and speculates about what levels of production are sustainable in the future.



Abundant, affordable oil has underpinned the way of life of developed nations for more than half a century. The final chapter, Aftermath, poses questions of how the world may cope with a shrinking supply of Arabian oil. Could the world live with 100-200\$ per barrel oil and will oil producers invest, meaningfully, the windfall revenues that would result? Will the world embrace energy conservation and learn to live again without produce and goods transported from the other end of the globe? Where will the

competition for supplies among energy-guzzling nations lead? Will scarcity and high prices stimulate the next energy miracle?

Twilight in the Desert is a thought-provoking book and one wonders why it took an investment banker to raise some of these fundamental technical, resource-base and world-economic issues. The book's analysis and conclusions are not a certainty, the data available are too fuzzy. As the author stated prophetically at a book launch in June 2005, they are more like a hurricane warning. Ignore it or heed it!

Alan Heward (PDO)

Fundamentals of Geology and Petroleum Geology Course

16-24 July 2005

GSO in partnership with Petroleum Development Oman (PDO), conducted for the second year running, the Fundamentals of Geology Course for PDO students. 25 students registered for the course which ran between 16-24 July at PDO's learning and development centre in Muscat.



This year's participants included 10 2nd year A-levels student from the ALC Centre in Muscat and 15 1st and 2nd year science degree students from UK universities. Due to the variety of background of the attendees, this years program was assembled to cover a broad range of subjects from looking at the basic components of rocks, minerals and fossil types available in Oman to the study of the tectonic history and stratigraphy of the region. The final technical session was devoted to a review of Oman's hydrocarbon plays. Away from the classroom, the participants visited PDO's exploration and production core shed at Mina al-Fahal where they viewed cores from various gas and oil fields around Oman. The highlight of the course was the Geology of Muscat fieldtrip which covered the main outcrops seen in the Muscat area.



The final part of the course was reserved for keynotes from PDO's chief geologist Mr Marcel Hamonic and the exploration gas manager Mr Mohammed Al-Harthy who talked about the role of geology and the geologist in the oil business. At the end of the course, the participants were invited to give feedback on the course to help improve and build on the current structure of the course. Course certificates were awarded to the participants by the GSO Vice President Dr Badar Al-Barwani.

GSO would like to thank Dr Yousuf Al-Aufi and Ms Hannat Al-Hinai for coordinating the course. The GSO would also like to thank Dr Yousuf Al-Aufi, Dr Saleh Al-Anboori, Mr Ibrahim Al-Zadjali, Mr Adil Al-Kiyumi, Dr Mahmood Al-Mahrooqi and Dr Alan Heward for presenting in the course and leading the fieldtrip.

Below are the impressions of two of the course participants, Haitham Al Hooqani and Omaira Mohamed Al-Riyami on the course.

Geology, a word that I had no idea about and all that came into my mind were just rocks. That was until the GSO came into action and delivered a lot to help us understand the basic concepts of geology in a week-long course before entering university to study it. Not just that but also looking at it 'live' in our beautiful country Oman.

The GSO first conducted the 'Fundamentals of Geology and Petroleum Systems' course last summer when I was about to go to the UK to study geophysics. This summer GSO continued the course, and being a first year student it enhanced my knowledge of geology from what I had learned in the university plus I learned more about the unique geology of Oman.

The course ran for 7 days which were really interesting and useful. During the first days, members from the GSO gave us presentations in mineralogy, weathering, geological time and depositional environments. On the fourth day, we visited the core shed in PDO where we saw real examples of cores and how some properties like porosity and permeability are measured and calculated. Additionally, we saw how rock samples from the subsurface are brought out from the field and then washed in the labs and how thin sections are made so that the features of the rock can be seen under the microscope. The real fascinating day within the course was the fifth day when we had a field trip in the Muscat area. The tremendous geological structures we saw were

Attending the geology course was a real benefit for participants to improve their knowledge of geology and generally of the oil and gas industry. By this I mean, we learned important basics of geological terminology and also a good understanding of the formation of oil and gas and how they are extracted with several high technology methods. In addition, we discovered the marvellous geological heritage of Oman. Undoubtedly, the course provided a new aspect for our interests and career to be developed in. Moreover, the variety of materials that were used to present and illustrate information enabled us to visualize and understand the different geological environments, structures and processes that we have dealt with during the course. Significantly, the field trips to the core shed and several sites in Muscat area emphasized what had been said in theory and the students were really enthusiastic about the magnificent geology of the sites and they experienced the atmosphere of a field trip. In my opinion, out of such activities we have recognized that our valuable geology and resources demand for more studies to be conducted to make the best output of them and more importantly to preserve them. One major advantage, the course helped



us to gain experience of working in seminars and identify the sort of attitudes that an employee needs to work in PDO. A last word to be said, all

really surprising to me as we went through the geological time of Muscat from the Hataf schist in Al Amrat to the Aeolian sandstone in Al Qurum. In the last 2 days we learned more about the petroleum system and the hydrocarbon plays in Oman.



Omaira Mohamed Al-Riyami
1st Year Bs.c in Geology

participants are very grateful to GSO and all people who organized and ran this fundamental geology course.

Haitham Al Hooqani
First Year A-Level student from Sultan School
Going for BS.c in Geology



A section through the Oman Ophiolite

Wadi Hamaliyah: 31st March 2005

Excursion Leader: Prof. Hugh Rollinson (SQU)



Early Thursday morning while many are fast asleep, enthusiastic geologists woke up with a mission in mind. In far history, 95 million years ago to be exact, oceanic crust was obducted onto Oman. GSO has kindly arranged for an igneous detective, Prof.



Hugh Rollinson, to take us along Wadi Hamalyiah and see these rocks and decipher their history and character.

Eight cars drove from Muscat along Al Batinah toward Swaiq. Just past the Swaiq roundabout we took a left turn for the Wadi, with a different spelling on the road sign.

Ophiolite is a name for the obducted ocean crust. The Oman Ophiolite, also known as the Samail Ophiolite, is one of the largest in the world and is superbly exposed and very accessible. At our first stop Hugh explained how the oceanic crust was obducted. A convergent margin NW of Oman ended

up, in contrast to usual, emplacing the heavier oceanic crust on top of the continental crust. The obducted ophiolites include a sequence from crust pillow lavas to the mantle.



At our first stop, we saw pillow lavas which are the most weathered of the sequence. Was it not for the road cut along one of the hills, one may not imagine the pillow lavas underneath.

We then moved into the Wadi looking at the next sequence, sheeted dykes. These dykes show clear evidence of intruding into their predecessors and splitting them. This is clear from the one sided chilled margins seen.

The next sequence (deeper) are the gabbros. In places these rocks are cut by dykes. Close examination of the gabbros reveals small scale structures similar to depositional structures seen in sedimentary rocks. The rock has alternations of plagioclase and pyroxene rich bands and sulphide seams.



We then moved deeper into the mantle. Although the mantle is usually extremely hot, the obducted mantle has already cooled. In fact, we had our lunch on the mantle (well under palm trees to reduce the heat).

After lunch we saw the mantle rocks. These are

usually chocolate brown Hertzburgite rocks with reddish brown dunite in places, locally cut by pyroxinite veins and hydrated serpentinite.

The boundary between the crust and the mantle is the Moho, a boundary that is usually 40 km below us. Thus it is no surprise to say that the highlight of our trip is when we finally touched the Moho. Smiles were clear on the faces. "take a photo", "at last we found it", "I actually spotted it from down the wadi", are just few examples of the joyful comments at the Moho. The trip was both pleasant and useful. We had many interesting discussions. Many thanks to the trip leader Prof. Hugh Rollinson and to GSO.

Ibrahim Al-Ismaili (PDO)



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continued...from page 1

Apologies that an edition did not appear in the summer, but, unfortunately we had too few contributions. This is your Society and your Newsletter, please use it to share knowledge and news of the geosciences in the Sultanate, and the wider region. We are particularly short of technical articles. The copy deadline for the winter edition is Wednesday 30th November, so get writing! Thanks to all contributors for this issue and keep the articles coming.

Eid Mubarak

John F. Aitken

Copy deadline for future issues

Winter 2005:

Wednesday November 30th, 2005

Spring 2006:

Wednesday February 22nd, 2006 (**NOTE:** This will be a special issue for the Geo2006 Conference in Bahrain)

CGG in Oman

31 years and counting.

CGG has been providing geophysical services in Oman for the past 31 years. It all began in 1974 when a CGG crew conducted an electrical survey in the search for water supplies. Since 1978 CGG has regularly acquired seismic surveys on behalf of PDO and other oil and gas companies. In 1994 CGG established a dedicated seismic data processing facility for PDO and has continued to provide this service till the present day.

Dedicated processing centre

At the beginning of 2005 PDO awarded CGG a new contract to provide dedicated seismic processing



services for the next four years with an option for an additional year. The processing centre is located in the Mina Al Fahal complex and currently has a staff of 35 geophysicists, 4 IT specialists and 5 administration & support staff. Typical annual throughput for the centre is 2000–5000 km of 2D seismic data and 8000–10,000 sqkm of 3D data.

Fahud success

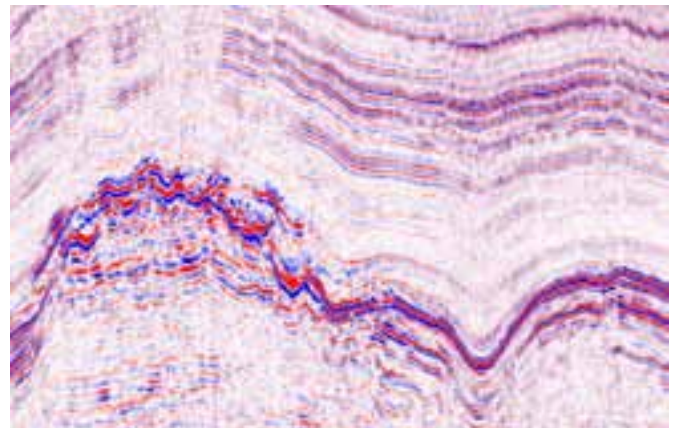
A recent success for the centre was the completion on schedule of the processing of the newly acquired Fahud field 3D seismic data. This very high-density survey was specifically designed by PDO to produce an accurate subsurface model to be used in the water flood development of Oman's oldest and largest oil field. Special effort was put into the determination of an accurate statics model which properly accounted

for the large variations in near-surface velocities. The combination of the dense seismic data acquisition with optimized seismic processing gave rise to much improved data quality over the crest of the field (see example section).



Omanization

Omani nationals make up almost half of the highly specialist workforce. The majority of those staff are graduates of the Sultan Qaboos University with which CGG maintains strong links through both its summer training programme and the provision of projects for final year students. Last year CGG donated the latest version of its Geocluster seismic data processing software to SQU.



CGG worldwide

CGG is a leading provider of geophysical products and services to the worldwide oil and gas industry. Geophysical services are offered through three strategic business units: Land Acquisition, Marine Acquisition and Processing & Reservoir. Sercel, a subsidiary of CGG, is the undisputed leading manufacturer of geophysical equipment worldwide. Indeed, much of the seismic data acquisition equipment currently deployed within Oman was manufactured by Sercel.

CGG recently acquired Multiwave Geophysical, a Norwegian-based provider of marine seismic services with a focus on multi-component, time-lapse and seabed operations. This acquisition is of strategic importance to CGG, consolidating its position as one of the top three seismic companies worldwide.

Contact Bill Henry (Bill.Henry@pdo.co.om)

Geological Society of Oman Annual General Meeting



The Annual General Meeting was held at the Intercontinental Hotel under the auspices of Mr. Mohammed Al Barwani (CEO of MB Petroleum Services). The guest speaker was Shahswar Al Balushi (CEO of OPAL - Oman Society for Petroleum Services). Below are





GSO INTERNATIONAL NEWS



INDIA



Production Sharing contracts (PSCs) were signed in New Delhi on 23 September 2005 for 18 blocks that had been offered in NELP V. Although the Indian government did entice bids from several majors, the country's usual players – ONGC, Reliance Industries and Cairn Energy – dominated the awards. The award of the final two blocks, delayed pending the resolution of all legal issues, took place late September 2005. Block AA-ONN-2003/1 (Assam-Arakan Foldbelt) has been granted to a consortium comprising Jubilant Oil & Gas, Jubilant Securities, Gujarat State Petroleum Corporation and GAIL (India). AA-ONN-2003/2, also in the Assam-Arakan Foldbelt, was awarded to Geopetrol International (operator 30%), National Thermal Power Corporation (40%) and Canoro Resources (30%).

Meanwhile, the government is considering proposals to amend the terms of the New Exploration Licensing Policy (NELP) in an attempt to encourage greater foreign participation and investment. One possibility is offering exploration blocks in future licensing rounds with varying terms determined by risk. India was already planning to move away from the offering of exploration blocks under the NELP in favor of an open acreage system, under which domestic and international oil companies would be able to apply for exploration acreage at any time. A prerequisite for an open acreage system, however, would be the establishment of a Central Data Repository (CDR), with exploration companies bound by law to provide data. It is anticipated that the CDR will take four to five years to establish, during which time the government will continue to offer exploration blocks under the NELP.

IRAN



If all goes to plan, Norsk Hydro should be spudding its third exploration well, Changuleh West 1 on the 2,700 sq km Anaran block, western Iran, on

7 October 2005. The well is located some 15km east of Azar 2 and has a prognosed total depth around 4,500m. Changuleh 2 was completed as an oil discovery in January 2000. It has an initial output capacity of 3000 bo/d and this is expected to rise to 7,500 bo/d after full implementation of a field development project. The first well, Azar 1 was plugged and abandoned on 4 February 2004 after an unsuccessful fishing job at a TD of 3,025m in the Mio/Oligocene Asmari Formation without testing the primary target at 4,500m. The block contains three main structures: Azar, Changuleh and Musian and was awarded to Norsk Hydro in April 2000 with Lukoil securing 25% through a farmin in September 2003. The contract has a first phase of 4 1/2 years, with an option to extend the contract for a further two years and carries an obligation for at least five wells with a financial commitment of US\$ 47 million.

IRAQ



The Ministry of Oil has awarded Irish independent Petrel Resources the Subba and Luhais oil field development service contract. Valued at US\$ 197 million, the project is to develop existing proven reserves as contractor to the Ministry of Oil and increase production from the current 50,000 bo/d to 200,000 bo/d, in addition to 100 MMcf/d of natural gas within a three year period. The Subba oil field is located in southern Iraq, some 105km south-east of the city of Nassiriya. Crude oil is currently being produced from the field in a single degassing station. The tender includes the expansion this facility and the installation of a new Subba Central degassing station. Luhais oil field, which is some 90km south of Nassiriya, is producing oil through a single degassing station and then transported via pipeline north-east of the field. The tender includes the installation of a new degassing station and expansion of the existing facilities.

While plans to drill the Nitzanim 1 wildcat remain suspended, Isramco has taken the Atwood Oceanics "Atwood Southern Cross S/S into the Med Ashdod I/9 lease in the Mediterranean Sea spudding Gad 1 on 25 September 2005. Located in around 100m of water, the well has a planned total depth of 2,600m and carries an estimated dry hole cost of US\$ 13 million. Three successful wells have been drilled within the area by Isramco; Yam 2 which tested 800 bo/d of 47° API in Middle Jurassic limestone and Nir 1 and 2, both of which have been declared as non-commercial gas discoveries. When drilled, Nitzanim 1 has a planned total depth of 5,300m, seeking oil in Jurassic carbonates and gas within Miocene sands at approximately 2,500m as a secondary target.

JORDAN



The National Resources Authority (NRA) has signed a production sharing contract with US Independent Sonoran Energy for the Azraq block marking the first such agreement to be signed by Jordan in eight years. This 11,250 sq km permit lies in the basin of the same name between the high central plateau in the west and the Basalt Plateau in the east. Following formal ratification of the PSA by the Jordanian Parliament, Sonoran will also take over operation of the existing producing wells in the Azraq Block's Hamza oil field. Sonoran intends to commence an aggressive evaluation program focusing both on exploration and the potential to boost production from the existing wells and facilities. This program will involve the acquisition of 3D seismic data and the drilling of two exploration wells, each to a depth of 3,000m, in addition to a number of technical studies. The Hamza oil field has been producing since 1985 from a primary fractured carbonate reservoir through a limited number of vertical wells. Drilled in 1989, the last well in the field is now producing about 30-40 bo/d, which is transported by truck to a refinery on the outskirts of Amman. In its re-mapping of the data, the company is confident that it has identified additional structures and potential new plays.

PAKISTAN



The Directorate General of Petroleum Concessions (DGPC) is taking competing bids until 27 October 2005 for eight blocks. Two are offshore in the Indus Delta -- the 833.78 sq km Offshore Indus-O 2266-7 EL and 900.36 sq km Offshore Indus-P 2365-3 EL -- while one onshore block is in the Middle Indus Basin, the 1,622.67 sq km Thal 2769-15 EL. The other five blocks are in the Lower Indus Basin: the 2,488.59 sq km Mithi 2470-3 EL, the 2,450.64 sq km Rajar 2470-2 EL, the 2,404.73 sq km Thano Beg 2567-11 EL, the 2,473.47 sq km Thar 2569-2 EL and the 2,499.77 sq km Umarmot 2469-8 EL. Applications are to be made to the DGPC, 1019-A, Pak Plaza, Fazal-e-Haq Road, Blue Area, Islamabad, Pakistan.

SAUDI ARABIA



In line with stated plans to more than double its drilling rig fleet over a two-year period, going from 55 in 2004 to a planned 110 in 2006, Saudi Aramco now has the Ensco "Ensco 76" J/U under contract and a second offshore unit will follow shortly. This is part of the Kingdom's ambitious expansion of its exploration program that will see several hundred wells drilled over the next few years. The Ensco 76, the largest rig ever contracted by the company, is deployed in the Arabian Gulf to investigate deep gas targets and is preparing to spud Karan 6. With a planned total depth of 5,180m, this well will be keenly watched as it seeks a high-pressure high-temperature reservoir. In total the company has 11 offshore structures ready for drilling and the second unit is expected in 2006. A number of such wells will be drilled to depths below 6,000m and the entire program is expected to take up to six years to complete.

SYRIA



Completed in mid August 2005, it has now been learned that the Rasm Al Koum 1 wildcat drilled by SPC in the "Central" area, Palmyra Zone, is a gas/condensate discovery. The well was drilled to a total depth of 2,969m and a drillstem test in the Kurrachine Dolomite between 2,495-2489m yielded 13 MMcf/d of gas and up to 190 bc/d

through a 32/64-inch choke. In July, drillstem test 3 recovered gas from an interval between 2,271-2,475m, while a test between 2,540-2,585m was dry; both were in the Kurrachine Dolomite. During May an interval from 1,726-1,760m in the Upper Triassic Mus Formation was tested unsuccessfully, and in June, a 70-minute test of the Kurrachine Dolomite between 2,298-3,350m failed to flow. The well was spudded on 10 March 2005 and sought multiple Triassic objectives.

TURKEY



Since the middle of September 2005 TPAO (100%, operator) has been offering stakes of up to 50% in three exploration licenses in water depths between 1,200m to 2,150m in the Black Sea. The three blocks are 3920, (11,968 sq km), 3921 (51,426 sq km) and 3922 (38,463 sq km) in the West and East Black Sea Sub-basins; each was awarded in June 2004 for a six-year term. Block 3920 contains six wells, two of which were drilled by Arco, including Limankov 2, which was abandoned with gas shows in 1999. No wells have been drilled in either or the other two blocks. For further information contact Exploration Manager, TPAO Exploration Department, M. Kemal Mah. 2. Cad No: 86, 06520 Ankara, Turkey. Tel: +90 312 2869004, Fax: +90 312 2869049 or e-mail: farmouts@petrol.tpa.gov.tr

One of a growing number of small Australian companies that are operating internationally, Ottoman Energy has firmed plans to drill its first two wells on the Edirne license, onshore Thrace Basin. Launched on the Australian Stock Exchange in December 2004, Ottoman focused its resources on this permit and the outcome seems very favourable, the company indicating it has mapped four structural prospects and several leads. Three of the four prospects have associated direct hydrocarbon indicators and are now ready for drilling. Bati Umur and Arpaci have been selected for drilling starting in late October and Koyustu will follow shortly thereafter, subject to satisfactory results from the first two wells. Reservoir targets in the first two wells are both less than 800m and are described as modest in size.

YEMEN



The Ministry of Oil and Minerals (MOM) has awarded rights to the onshore 1,998 sq km Block 4 (Ayadh) to Korea's KNOC. Unconfirmed reports indicate a signature bonus of US\$ 55 million will be paid in return for an operating 50% interest in the acreage, with a minimum financial commitment of US\$ 157 million to conduct additional exploration and development operations.

Like the Chinese and Indian companies, KNOC is expanding around the globe, an example being its participation in the UK's 23rd Licensing Round. In Yemen, the company made its entrance earlier in 2005 with the acquisition of a PSA for the 1,367 sq km onshore Block 70 (Atiq) in the Shabwa Proving, and the promotional Block 39 (Damqawt), which encompasses some 5,273 sq km.

In October 2005, 15 months after signing a Memorandum of Understanding, Oil Search (60%) and private Turkish company, Petroleum & Petroleum Products International Exploration and Production Inc. (Petoil Inc. 35%), received parliamentary approval of its PSA for the onshore 2,953 sq km Gardan Block 3 concession in south-west Yemen. A US\$ 10 million minimum work commitment is believed to call for the acquisition of 600 sq km of 3D seismic and drilling of at least two exploratory wells. Yemen Co. has a 5% carried interest. This permit adjoins to the south the company's Block 7, one of two Shabwah Basin permits won by Oil Search earlier in 2005. OMVs recent Habban 1 basement discovery, which included a 750m oil column lies immediately to the west and is on trend to basement structures identified in both Blocks 3 and 7. It appears to be the first granitic basement discovery in the Marib-Shabwa Basin, following a recent series of similar discoveries in the Sayun-Masila Basin.

With thanks to IHS Energy

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A delegation from the Geological Society of Oman presented a paper (oral and poster) on the potential of Geotourism in Oman on the 27th of September 2005. The conference System Earth-Biosphere Coupling was held from the 24-29th of September 2005 at the Friedrich-Alexander-University in Erlangen-Nuremberg, Germany. The presentation of the GSO paper coincided with Oman's celebration of the World Tourism Day. In the presentation, the GSO highlighted Oman's great potential for Geotourism and called for the formation of Geoparks. The GSO also highlighted the need for the various unique geological assets to be managed in a responsible and sustainable fashion. Furthermore the GSO stipulated the vision for the future of Oman's Geological heritage and that is that all the these geological assets should be known, made accessible to a wide range of users, enjoyed in a responsible and sustainable manner and passed on intact to future generations. The GSO posters on Geotourism and geo-conservation were one of the major attractions in the poster session.

Other papers in the Geotourism theme included a talk by Eder, F. W., a senior advisor of the UNESCO. The talk entitled "UNESCO's Global Network of National Geoparks-a tool for recreation and promotion of geological heritage" which emphasized the need of respecting nature by better understanding the value of nature and promoting "Geoparks as an educational tool".



GSO EVENTS CALENDAR

2005

November

8th November 2005

"World Stress Database (WSM)"

Mark Tingay

World Stress Group

University of Karlsruhe, Germany

17th November 2005

"Geology of the Muscat Area"

Dr Mia VanSteenwinkel

Petroleum Development Oman

22nd November 2005

"The Arabian Lithosphere: Petrology, Mineralogy and Geothermal gradient: Xenolith Study"

Dr Subhi Nassr

Department of Earth Sciences SQU

29th November 2005

HAO

December

1-2nd December 2005

Geology of Jebel Madar "Shuaiba"

Zuweina Al-Rawahi

Petroleum Development Oman

14th December 2005

"GeoConservation and GeoParks"

Tony Weighell

Joint Nature Conservancy Council, UK

20th December 2005

"Artificial neural networks and 4D seismic"

Dr. Ibrahim Al-Ismaily

Petroleum Development Oman

27th December 2005

"Past & Present Exploration in the Gas-Condensate fairway of the Deformation

Front of the Oman Mountains"

Dr John Hurst

Novus Oil Company

29-30th December 2005 (or 22-23/12/05 or 5-6/10/06)

"Geology of Jebel Sumeini area"

Dr. John Hurst

Novus Oil Company

2006

January

17th January 2006

"Preserving the Huqf"

Mike O'Dell

Petroleum Development Oman

19-20th January 2006

Fahud-1 Anniversary Exhibition

24th January 2006

"Factors influencing the deposit geometry of turbidity currents: implications for sand body architecture in confined basins"

Dr. Omar Al-Ja'aidi

Sultan Qaboos University

February

8th Feb

HAO-GSO Oman study day

8-10th February 2006

"The Geology of the Bar El Hikman Area"

Dr. Volker Vahrenkamp & Prof. Peter

Homewood

PDO & JVRC Centre

21st February 2006

"Sand Beach, Mechanical Rig & Structural Geology"

Dr. Bader Al Barwani

Petroleum Development Oman

28th February 2006

"The search for petroleum in Oman- further twists in the tale"

Dr. Alan Heward

Petroleum Development Oman

March

21st March 2006

"Reconstruction of the Jebel Akhdar Tectonics...Radical new interpretation"

Dr. Mohammed Al-Wardi

Department of Earth Sciences SQU

23-24th March 2006

"Reconstruction of the Jebel Akhdar Tectonics..."

Dr. Mohammed Al-Wardi

Department of Earth Sciences SQU

28th March 2006

"Mud Volcanoes: why can you not find them in Oman?"

Dr. Ray Archer

Consultant Petroleum Geochemist

(Reslab LLC)

April

25th April 2006

"Climate Changes, Methan Burbs, Funny Waters and the Shuaiba Formation – A Geochemical Story"

Dr. Volker Vahrenkamp

Petroleum Development Oman

May

30th May 2006

GSO Annual Meeting

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