

President's message

Dear GSO Members,

We will soon celebrate together another successful year for the Geological Society of Oman. The GSO would like to take this opportunity to thank all its members and sponsors for their kind support. In reflecting back on this year's achievement, I am extremely proud of how the executive committee has served you. We have seen an increase in the number of members attending our field-trips; the Mars talk was a tremendous success and well attended not only by our society but also by members of the community. Furthermore we have had some excellent speakers in our monthly talks. These activities are designed specifically to enhance our member's geological awareness. We in the GSO believe that a geoscientist should know how to describe rocks from outcrops, in cores, and under the microscope. Universities in the region and the industry seem to be getting stronger in the software approach to geology at the expense of the rock-description approach. We believe that local activities led by GSO members will continue to fill part of this mentoring need with the continuous support from our GSO senior members and sponsors.

Omar Al-Ja'aidi

Note from the Editor

When I look back at four months since our last publication, I am so impressed at how the society has grown in stature, and the recognition it is earning within the Geocommunity at large, and in Oman and the region, as a leading scientific society. This success will be the foundation for further growth and development, but this will not be achieved without the active support and help of the membership. This is your society and it is here to promote an understanding and awareness of Earth sciences for both the professional and academic communities. Al Hajar is an opportunity to share knowledge and I would like to send out an impassioned plea for people to submit articles that can be published.

Unfortunately for me my time in Oman is coming to an end, and I will be transferring to another posting. My time here has been very special, the country, the people, and even the Geology have been most welcoming and the memories I will take with me will last forever. My duties as editor have been picked up by John Aitken, Chief Geologist for Badley Ashton. John is an accomplished Geologist with long experience from both academia and the oil industry. He is affiliated with a number professional societies and has published numerous articles. I am sure you will all welcome him to his new role.

John Willoughby

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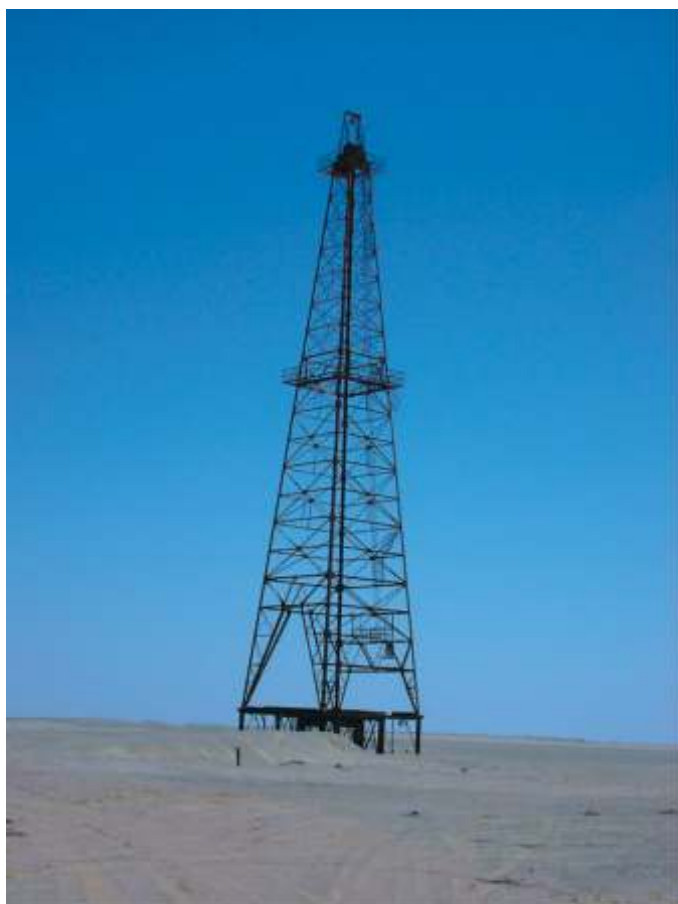


Saiwan Area of the Northern Huqf:

from cryptospores to glossopteris, bennettites and Vaccinites - all in a weekend!

16th-18th March 2005 Trip Leader Alan Heward (PDO)

Six cars left Ras Al Hamra at 07:30 and drove to Seeb to meet another vehicle, the final participant was met in the Huqf later that afternoon. Following a brief coffee stop at Adam to view the surface anticlines and be introduced to the geology of the northern Huqf the party



Ghaba-1 well derrick

drove to Ghaba, where all the vehicles were refuelled. We then proceeded to the site of the Ghaba-1 well, with the derrick still standing. Here, Alan discussed the early hydrocarbon exploration of Oman by the Iraq Petroleum Company and the fact that some of the earliest land plants have come from Ordovician cores in Ghaba-1. Fortuitously, BGP (a Chinese seismic company) were acquiring seismic around the Ghaba-1 well, so not only could we view early- to mid-20th century technology in the form of the well derrick, but also 21st century technology in action.

The party then passed into the Huqf along the Abu Zeinah graded track and onto an old seismic line to reach fossiliferous Lower Khuff Formation storm beds at the entrance to the Haushi anticline displaying a variety



BGP Vibroseis truck

fossils (including brachiopods, ammonoids, corals etc.), gutter casts and large wave ripples. Next bizarre, drainpipe-like iron cementation in the Al Khlata Formation was viewed adjacent to the Haushi-Nafun fault (part of the Maradi fault zone). The origins of this cementation and its peculiar cylindrical nature are not understood but are undoubtedly linked to fault-related mineralisation.

The remainder of the afternoon was spent examining the Gharif Formation at various sites and included multistorey, cross-bedded fluvial sandstones overlying palaeosols at 'The Pinnacle' and palaeosols in the Upper Gharif. The swelling nature of many of the clays in the Gharif palaeosols was well-displayed by the heavily degraded nature of the outcrops following the



Drainpipe-like iron mineralisation in the Al Khlata Formation



Yardang (wind-sculpted) Gharif Sandstones

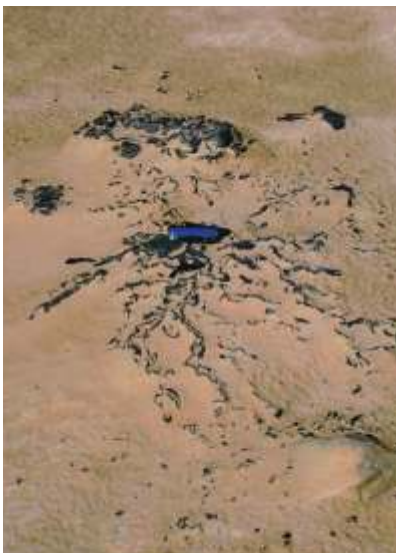
recent rains. In addition, the first of several silicified wood exposures and plant-bearing shales were visited before setting up camp in the North Cliffs.



Multistorey fluvial sandstones at 'The Pinnacle'

The following morning the oil seeps (oil volcanoes) at Hasha Bahr were visited and Alan explained how they were discovered and why they are here, before returning to the Gharif to view large spiriferid brachiopods overlying the top of the Al Khlata and the Haushi Limestone and its constituent fossils (including bryozoa, crinoids and conularids).

Subsequently, desert varnished Lower Khuff outcrops were visited and there was discussion on the origins of desert varnish. The next stop was at a globally important site in the Haushi Limestone (Saiwan Formation) where beautifully

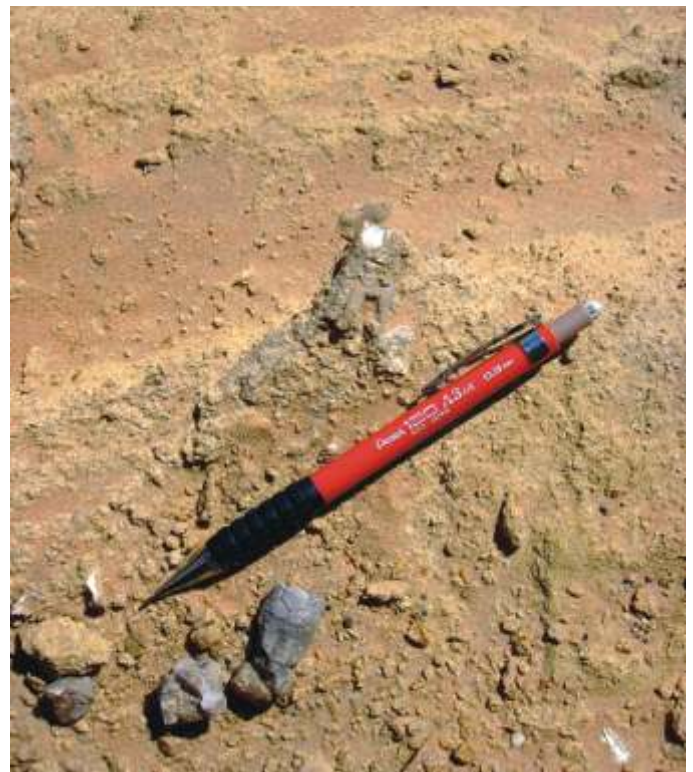


The oil seep at Hasha Bahr



Large silicified tree trunk in the 'Fossil Forest'

preserved crinoid calyxes and arms occur, probably as a consequence of storms flattening fields of sea lilies. These superb crinoids have barely been studied, but two new species have been identified and there are possibly more new species waiting to be discovered. Worryingly, this outcrop is very close to the new Ghaba-Mahout Road and is in urgent need of conservation.



In situ crinoid clavicle with arms

The Cambro- Ordovician Amdeh Formation of Wadi Amdeh and Wadi Qahza

3rd March 2005

John Aitken (ResLab-BadleyAshton Alliance)

In the hit and miss of the winter weather, a 4 car group left for a blue sky day in the green wadis of Saih Hatat to find the rains had washed out all John's carefully prepared track markers and left navigational challenges in their place. John's field guide however kept the group on track, on an excursion assembled in his weekends!



John introduced the several km thick quartzites and silts of the Amdeh Formation as problematically located within Oman's stratigraphy with only speculative correlation of the sequence into the subsurface as anywhere between Barik to Ghudun equivalents. Jean

Paul Breton put the overprint of greenschist facies metamorphism into regional context. The absence of these clean sands in the Jebel Akhdar area provides a fascinating insight into variations in local basin accommodation.

The first stop at the base of the Amdeh Formation fired up a fluvial versus marine discussion at a complex facies 'triple' junction between conglomerates, silts and sands. The new discovery of granite clasts kicked off a prevailing theme in the day of the possibilities for further field work. Further into Wadi Amdeh, John introduced the variety of

sedimentary structures and beautiful trace fossils; upturned block covered in Rusophycus (the trilobite resting trace) and the sectioned sand volcanoes were highlights. A second discovery outcrop of a heavily oxidized, clast-rich feature prompted comparison with injection structures seen in the Al Khlata.



After a Reslab-sponsored lunch, the group back tracked into Wadi Qahza to visit a string of exposures including the famous wave rippled sandstones of Oman Geological Heritage text. The abundance of trace fossils and structure allowed Alan Heward and Jean-Paul Breton to spark the groups broad interests. The Cruziana trilobite traces held out to the last minute before discovery whereas the enigmatic Daedalus allowed great discussion not least on what shape it actually was. At least, compared with the vertical Skolithos tubes.

*Thanks to Ed Follows of PDO for this write up.

24th INTERNATIONAL ASSOCIATION OF SEDIMENTOLOGISTS MEETING SCENIC SEDIMENTOLOGY MUSCAT 2005:

Muscat Oman 10-13 January 2005



Between the 10th and 13th January, 2005 the GSO co-hosted, with the Carbonate Research Centre and the Department of Earth Sciences of Sultan Qaboos University, the 24th Meeting of the International

Association of Sedimentologists at the Sultan Qaboos University. This was the first IAS meeting to be held in Arabia. Approximately 260 registrants from 34 different countries attended the four day meeting that comprised a single main oral session with several poster sessions with each session having at least one keynote address. The meeting was opened with a ceremony under the patronage of HE Mohammed Al Rumhy, the

Minister of Oil and Gas, and was addressed by two keynote talks by Professors Bob Ginsburg and Ken Glennie talking about Carbonates, Oman's geology, Industry and Academia. Fifteen fieldtrips, one sponsored by GSO, visited a variety of destinations: modern deserts and carbonate systems, Precambrian and Permian glacial deposits, Neoproterozoic, Permian, Cretaceous and Tertiary carbonate and clastic deposits, Tethyan margin sequences, the Oman ophiolite and regional geology around Muscat. The GSO Executive Committee expresses its gratitude to the organising committee in arranging such an excellent conference in the Sultanate: Peter Homewood (Chairman), Abderahman Al Harthy (Secretary), Hisham Al Siyabi (Treasurer) and Monique Mettraux (Coordinator), with the close support of Asma Al Saidi (Webmaster), Omar Al Ja'Aidi (IAS National Correspondent), Sabine Vahrenkamp and Zuweina Al Rawahy (Social

Field Trip to the Saiq Plateau

25 and 26 November 2004

Felicity and Alan Heward



The party in the foreground and the hotel in the mid distance on the Saiq plateau.

This excursion was to the Permian Saiq and Mahil Formations widely exposed around the town of Saiq. Gordon Coy of Badley Ashton was our guide, having worked on these rocks for his Ph.D. Twenty-four of us drove down through the Semail gap, with views of the platform sequence, the Hawasina and the Semail ophiolites. Two others from Dubai joined us at the Al Jebel Al Akhdhar Hotel. We were a diverse group ranging from carbonate experts, geologists or geophysicists, to enthusiastic naturalists and a reservoir engineer with a son interested in fossils. The drive up the jebel was an adventure in itself. The road is mainly blacktop now and of good quality, but it climbs fast with great views in every direction.

After a buffet lunch, we spent the afternoon walking through a stack of shallowing-upward cycles in the Saiq on the hillside just west of the hotel. The outcrops are at over 2000 m and the going was rough underfoot

on the distinctively fractured and weathered dolomites. There was a lot more detail to be seen than meets the casual eye, from deeper-water storm deposits, to cross-bedded oolites and shallow-water mudstones. Fossils ranged from large thin-shelled clams to torpedo-shaped fusulinid foraminifera. Gordon rounded off the afternoon with a discussion of the Saiq and Mahil Formations of the mountains and their equivalents in the subsurface, the Khuff and Sudair. Dusk was falling as we began the walk back down the hillside to the hotel.



The GSO party Friday 26th November, with one or two villagers.

What we never discussed, even though we were staring at it all afternoon when we looked at the view instead of the dolomites, was the origin of the flat Saiq plateau that crosscuts the geology. Arthur van Vliet subsequently speculated that it may represent erosion to an old water table.

Certainly a feature worthy of more observation and thought.

At supper Randall announced the evening entertainment of stargazing. It was not an ideal night as the moon was nearly full, but with the right filters we were able to view the surface of the moon with all its craters. Randall used his laser pointer to show us the main constellations, but some of us were too cold to wait for Saturn to rise above the hotel (overnight temperatures dropped to 6°C). We never did discover what 'The Terminator' was, but gathered it is on the moon rather than in California!

Next morning we set off for 'Diana Point', so named after a visit of the Princess of Wales. Visibility was fantastic; the wadi below and the surrounding mountains were clear, and there were lots of photos taken of the cloud swirling up other wadis. The Lower Saiq there is of limestone

A lovely view of cultivated terraces watered by springs emerging at the Saiq-Huqf unconformity. We returned to the Lower Saiq limestones adjacent to Saiq town and were impressed by the diversity of fossils, including several superb corals. Discussions of different types of dolomite followed. The pervasive seawater-derived dolomites of the Saiq and Mahil and much of the Khuff and Sudair imply massive circulation of brines over hundreds of kilometres from the Tethyan ocean. Iron and magnesian-rich fluids probably formed other crosscutting bodies of dolomite during the emplacement of the Semail ophiolite.

The final stops of the morning were in the Mahil, and according to the GPS, we were at over 2300m. There were a surprising number of trees growing, including junipers (al alan) and wild olive (utm). Even though the sun was



Cultivated terraces on the Huqf shales and diamicts, the more massive cliff of the Lower Saiq limestones and buff-coloured deposits of travertine on the left. Villages of Al Shurajah, Al Ain and Al Aqar.

rather than dolomite, with burrowed interbeds. Apart from using acid to tell limestone and dolomite apart, the experts told us that you can 'stroke a limestone but not a dolomite.' Makes a change from eating rocks as clastic sedimentologists encourage us to do.

The next couple of stops were to view the Pre-Cambrian shales and diamictites lying beneath the Saiq. There was

shinning, it was cold enough for a jumper. We looked at dolomitised grainstone shoals and finely laminated intertidal/supratidal sediments. Paul found a lovely hand specimen of finger-like stromatolites, unfortunately by the road and not in-situ.

It was time for lunch and whilst most of us ate, Randall busied himself setting up his solarscope and telescope so

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Another site close to the new road is the so called Gharif fossil forest, comprising silicified, aligned tree trunks deflated out of upper Gharif channel sandstones. This locality also requires urgent conservation before someone comes along with a lorry and takes all the wood away to sell. Not far from the fossil forest more Gharif silicified wood, this time embedded in Gharif sandstones occurs, along with granulation seams that mark the damaged zone of the Maradi Fault Zone. These granulation seams have various orientations and indicate differential directions of movement on the fault.

Following a relaxing lunch under a tree overlooking the sabkha and dunes we drove across the sabkha to revisit the Khuff and a lateritic palaeosol and overlying plant-bearing sandstone of the Minjur (equivalent to the Mafraq) Formation. The day ended with an exciting drive across the sabkha and gravel plains to visit the famous Late Cretaceous, Samhan Formation giant rudists, that outcrop for in excess of 15km. The wind was strong and we were all sand-blasted, but fortunately Jean-Paul Breton knew of an excellent sheltered, amphitheatre where we made camp for the night.

The next morning was spent examining the rudists, especially the exceptionally large *Durania*, with further discussion on the chemistry of the ocean in which these bivalves grew, deciding that it must have been 'soup' to permit them to grow so large.

...Continued from Page 6

we could view the sun. And so some viewed sunspots, others looked for indicators of shallow-water conditions in the Mahil, and still others admired the views and vegetation. In due course Mohammed proposed a vote of thanks to Gordon for leading such an interesting trip to a



Randall enlightening us on the view through the solarscope.

Saiwan Area of the Northern Huqf:



Rudist biostrome within the Samhan Formation

The final stop of the trip was at a star dune near Ghaba, which some of the party climbed to gain excellent views across the Northern Huqf and towards the Tertiary escarpment. A final refuelling (both cars and bodies) stop was made at the Ghaba Resthouse and Alan was awarded a commemorative GSO plaque.

This trip was extremely good, benefiting from Alan's encyclopaedic knowledge of Oman's geology and the early oil industry in the Sultanate. Thanks are extended to Alan for his efforts in organising the trip (as well as the geology, some of the driving was fun too!).

Field Trip to the Saiq Plateau:

beautiful area. We all then began the drive down the mountain to Birkat al Mawz and on to Muscat. Arriving back in the humid heat of the Capital Area brought a sense of anti climax, and the thought of stroking limestones in the cool of the Saiq plateau definitely had its attractions.



Gordon with his GSO medal.

Fahud in the spotlight again with New Seismic

By the PDO Geophysics Department



The Fahud field, located in North Oman, was discovered in 1964 and is roughly 17 km long by 2.5 km wide, with an estimated STOIIP of more than 6 billion barrels of oil, making it the largest field in Oman, STOIIP wise. To date, more than 390 wells have been drilled in the Fahud field.

During Waterflood Scouting Studies in early 2003, the Fahud Project was identified as one of the key projects to boost PDO's production. Notwithstanding the long production history, reservoir heterogeneity is a key uncertainty. New state-of-the-art seismic data were identified as one of the means to reduce subsurface uncertainties. In the past the Fahud field has been covered by both 2D and 3D seismic and the last seismic data over the field was acquired some ten years ago.

In order to demonstrate the potential impact of new seismic, a small scale seismic pilot was executed. Indeed, this pilot demonstrated that new seismic would likely deliver a superior image of the subsurface. Subsequently, PDO's Decision Review Board approved the proposal from the Fahud Asset to acquire new seismic data over the entire Fahud oil field.

The Geophysics Department, supported by people from the Fahud Asset, the Fahud Team in the PDO Study Centre, the PDO Technical Service Group (GeoSolutions) and Veritas DGC (seismic contractor), designed a new 3D seismic survey. The APIR team (representatives from the Geosolutions and Fahud teams) had many meetings to design and optimize the survey parameters to ensure adequate sampling of signal and noise (to allow for noise elimination in seismic

processing). The key parameters are the sampling of source and receiver points (number of points per unit area) and geometry details, which are based on a detailed evaluation of the 2003 pilot results. This chosen geometry results in a nominal coverage of 80 seismic traces at target level (i.e. within a 500 m offset range). The data density is 16 times higher than the 1994 acquisition. This dense acquisition grid allows compensation for small coverage gaps as a result of missing source and receiver points. Another key to solving the 1994 poor data is improving the statics solution. Considerable effort is placed on obtaining shallow velocity information via upholes, Vertical Seismic Profiles (VSPs) and DSI sonics. This, integrated with shallow refraction statics and with topographical/remote sensing information, has the capacity to considerably improve data quality.



HSE is of primary importance, right from the beginning as the Fahud Jebel area makes any seismic acquisition a very hazardous job. The existing infrastructure in the area adds another dimension to the work. HSE workshops, weekly operations meetings, quantitative risk assessments, environmental impact assessment, job safety analyses and field visits are a few examples of what was done prior to the start of the main operations. Field work, which included detailed field scouting and surveying of all seismic survey points started in fact early in 2004 with the help of professional mountaineers. After a lot of hard work, the seismic crew (some 250 staff) arrived in Fahud on 17th August to start data acquisition. To



Fahud Jebel area: a challenge for seismic operations!

cover an area of 150 square km with new seismic the crew have completed some 120 thousand vibration points and planted 1.4 million receivers to generate and detect the seismic waves, respectively i.e. 29 billion seismic traces. The seismic acquisition was completed successfully on the 11th February 2005, some 3 weeks ahead of schedule and incident free. Seismic processing has begun and will

take some 4 months to complete. Initial indications from stacking random seismic lines shows that data quality is better than the 1994 data: horizons are coherent and continuous; faults are delineated, and energy can be seen through the target zones. Shortly, a new high quality image of the Fahud subsurface can be loaded onto computer workstations for detailed interpretation by the Fahud Team to assist in the water flood development of the Fahud Field.



Vibroseis recording through the rough terrain

Geological Heritage of Oman: a Treasure!

By Mohammed Al Mazrui & Badar Al-Barwani



There is no where in the world where the phrase “geological heritage” is more relevant than here, in Oman, where the diversity of Oman’s geology is interleaved with people’s day to day activities. The geological heritage of Oman is a treasure that deserves to be looked after and shared. At a global scale the conservation of geological heritage is given a top priority as stated during the United Nations Conference of Environment and Development (UNCED) in 2002. It is believed that “A good knowledge of geological heritage - and a healthy respect for all it represents - is an important factor in the holistic approach for sustainable development”.

To celebrate Oman’s geological heritage the GSO initiated committees to promote conservation of the geological heritage. The main role of the “Geological Conservation and Heritage Committee” is to highlight sites of great importance



from an aesthetic, historical and scientific point of view. This will be followed by a listing process of all these sites as sites of special scientific interest. Some of these sites are planned to be converted into geo-parks, which can be visited by the public at large. The geo-parks, will also act as basis for promoting geo-tourism in Oman. The committee is currently working with other groups and governmental bodies towards protecting and promoting these sites. The committee is also launching an awareness campaign ‘the past is the key to the future’ to educate the public on the importance and significance of our geological heritage.

For more information visit the committee section on



The Infracambrian Ara Group Salt Domes of Qarat Kibrit, Qarn Alam, Jebel Majayiz 24-25 February 2005

Hisham Al Siyabi & Mark Newall (PDO)

A group of 11 cars and 2 Shuram support vehicles took a number of participants to three of the six surface-piercing salt domes in North Central Oman in 2 days. Shuram served their renowned fresh cooked and shaded meals that

make it difficult to believe this is uninhabited desert at other days of the year. At Qarat Kibrit, Hisham kicked off with a poster summary of the Geoarabia 2003 paper used as the



basis of the guide. Pictures of the salt glaciers in Iran whetted the appetites for discovery and a roam into the cave in the Precambrian salt. After lunch, Mark and Hisham led the group to unique salt exposure features including polygons, karst and anhydrite cap rocks as well as identity confirmation by taste. All the salt domes provide some relief on the vast flat horizons of the interior of Oman; cm to 500m width scales of extruded, fetid, grey Ara Group limestone blocks at angles against the sky. Originally interbedded within the salts, the limestones are a new producing reservoir



in Oman, the stringers. Said Al Balushi shared his detailed work on best exposed Ara section before dark. After dark, the GSO kept the entertainments coming first with

Janos Urai on the history of salt, Salim Al Maskery on safety aspects of desert trips, then lastly Randall Penney on a tour of planets and double stars.

After breakfast, the evaporite – free Qarn Alam dome exposures provided the opportunity for Said to focus us further into his study of the Ara Group. At least two several metre thick shallowing cycles stack thrombolites (microbialites with an internal clotted texture) on the laminated fabrics seen in the first dome, capped locally with grainstones and erosional truncation surfaces. The group verified the correlation of the same sequences between the three large Ara blocks. Hisham then translated the vertical column into a lateral facies model, but unfortunately time constraints prevented the group directly comparing with the in situ Namibian outcrops.

The last stops at Jebel Majayiz added stromatolite and conophyton stacking patterns to the Ara facies observed. Cherts and faulting were rather more in evidence, perhaps a result of this dome sitting in the Maradi fault zone.

Lots of fun questions were posed which included... Is the lamination seen in the salt primary bedding or generated by the uplift of the salt and block sequence from 10 km down?

Where are the blocks from the stratigraphy between the Ara and the surface?

Why does Jebel Majayiz have so many blocks? Is this a function of sitting on the Maradi fault zone? Is it possible that the number of blocks log jammed the dome (in Janos culinary terms, the pistachios didn't get enough honey to move)? Did the blocks all come up at once or have they been dumped out in the erosion process?

*Thanks to Ed Follows of PDO for this write up.

GEOLOGICAL EXPLORATION IN OMAN: THE EARLY YEARS

*50 Years
anniversary of
Fahud*



This article in the last Al Hajar came out missing one vital mention- the author's name. The

author was **Quentin Morton, Mike Morton's son**, who is writing up the geological exploits of his father in the service of the Iraq Petroleum Company 1945-1971 and then on various expeditions, like the Royal Geographical Society one to Musandam in 1971-72. Quentin, a lawyer by profession, has now nearly completed his father's biography and hopes to find a publisher later in the year.

Thanks Quentin for your contribution to Al Hajar and sorry we inadvertently missed your name from the article in November.

Terrible Lizards in the Melbourne Museum

Rifaa Al-Harthy



Imagine standing in the middle of an island, surrounded by hungry monstrous beasts, with large teeth which could easily crush your bones in seconds! Do you have that image in mind? Well, fortunately, it's only imagination. Dinosaurs lived during the Jurassic Era and got extinct around 65 million years ago.

You may wonder why I'm suddenly interested in dinosaurs. It all started the day I had an interesting discussion with a friend of mine after visiting the Melbourne Museum and seeing the magnificent skeletons of the "terrible lizard". The debate revolved over the truthfulness of dinosaurs, the reality of their existence, in addition to how they all became extinct in an instant and the evidence provided to us proving that they existed once upon a time.

Let's step back in time, precisely to the year 1824. Imagine walking along the quarries in England when suddenly you stumble upon an object. When inspecting it closer, you realise it's a gigantic jaw with razor sharp teeth protruding from it. You quickly pick it up and start investigating the hidden secrets behind your discovery. This discovery was accomplished by William Buckland, who discovered the first lower-jaw bone of a dinosaur. In addition, a group of geology students from the Sultan Qaboos University also discovered dinosaur bones during their field work around the Al-Khoud area; indicating that these animals once hovered over this very land.

Fossils, bones and skeletons are nature's way of explaining the stories and events of the past. Fossil, a Latin word for "dug up" is defined as "any evidence of the past" illustrating the pre-existence of living organisms. Fossils come in various shapes and sizes; however, the process of fossilization is usually standard. As an organism dies, its remains- mainly bones and teeth- are imprinted on rocks or sand. It is a creature's way of saying, "I was here"!

Fossils also provide essential information about the origins of life on Earth. Palaeontologists-scientists who study past animals by looking at fossils- are able to determine the age, type of diet and sometimes the reason behind a creature's death. This is done by examining an animal's bone density, type of teeth and size. For example, herbivorous dinosaurs tended to have long necks in order to reach the leaves at the top of trees. In addition, their teeth are not as sharp as their carnivorous counter parts. Furthermore, by comparing the skeletal structures of previous animals with those we see today, scientists are able to gather vital information leading them closer towards the truth about our past. Although, complete skeletons of dinosaurs have not been discovered, palaeontologists have been able to piece together various skeletal outlines that give birth to our limited knowledge of dinosaurs.

An intriguing question which always arises when talking about dinosaurs is, "did they all suddenly become extinct?" This question still gives rise to numerous research and debate between geologists and experts in the field of



palaeontology. No one is really sure how or why dinosaurs disappeared; however, there are a number of evidences and theories linking back to the time dinosaurs vanished about 65 million years ago. Some of these include: sudden changes in climate, asteroids, and volcanic activities.

Looking back in time, it is impossible to claim that dinosaurs became extinct suddenly. All the above theories, must have taken several years to have its final impact. In addition, I believe that a number of sequential events lead to the disappearance of these magnificent animals. The discovery of an asteroid in Mexico was one of the first leads to the theory of the dinosaur extinction. It is said that the great force and impact of the asteroid caused catastrophic changes on Earth. Global fires, earthquakes and tidal waves were all possible outcomes of the impact. Furthermore, as the asteroid collided with the Earth's crust, debris and dust exploded into the atmosphere. As a result, earth was in a "black out". Sunlight failed to penetrate the atmosphere causing a reduction in plant photosynthesis and the increased accumulation of carbon dioxide. Consequently, plants died followed by herbivorous animals then carnivores.



Finally, I would like to state that "Life is a mystery" that always has a story waiting to be explored.

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Rifaa Al-Harthy
 GSO Member January 2005
 Email: rifalharthy@hotmail.com



GSO INTERNATIONAL NEWS



INDIA



It looks like the long dry spell in the "Sagar Samriddhi" deepwater exploration program is over as ONGC has made its second "significant" gas discovery in the Krishna-Godavari Basin. The G-1-12 (G-G-1-H) well on KG-OS-DW-IV block has encountered about 42m of gas pay in multiple sands between 1,962m and 2,182m. It was drilled by the Transocean "Discoverer Seven Seas" S/S to a total depth of 2,449m, testing a structure with an aerial extent of 9 sq km and potential reserves between 4 and 6 Tcf. A month earlier, ONGC announced it had made the G-4-3 discovery, which has 56m of pay between 1,650 and 2,133m. That 2,672m well was tested flowing 14.1 MMcf/d from a single Pliocene sand between 2,100 and 2,200m (IOL, 14 Feb. '05). The wells are ONGC's first successes in Sagar Samriddhi or "prosperity from the ocean," a US\$ 13.9 billion deepwater exploration program that kicked off in the fall of 2003. In addition to the "Discoverer Seven Seas," ONGC is employing Dolphin Drilling's "Belford Dolphin" and ONGC's "Sagar Vijay" at a cost of about US\$ 750,000 per day. ONGC plans to drill a total of 47 deepwater wells in water depths between 400-2,700m in an attempt to add four billion tons of oil and oil equivalent gas to its existing reserve base.

Cairn Energy has confirmed that its N-V field does indeed extend into the recently awarded north-western portion of the RJ-ON-90/1 (Rajasthan) block. The N-V-1ST appraisal encountered 320m of net high quality Palaeocene Fatehgarh Formation oil pay sands (equivalent to 104m of true vertical net oil pay). It was drilled to a total measured depth of 1,483m, or 666m true vertical depth. Preparations for an open-hole test were underway in mid-February and it is anticipated that the well will be suspended as a potential future producer prior to the drilling of two additional appraisal wells. The N-V-1ST has a common oil-water contact with the N-V-1 discovery, located about 750m away. That wildcat was drilled during the summer of 2004, encountering an oil column of 62m with an estimated 35m of net oil pay in excellent quality Fatehgarh Formation sands. The top of the formation was encountered at a depth of 590m. An open-hole test program was conducted over a 10m interval just above the oil-water contact yielding 21° API oil at undisclosed rates. Located near the original north-western boundary of the block, the N-V prospect is 18km west-north-west of its significant N-B-1 (Mangala Field) oil discovery and 19km west-south-west of its N-C-1 oil discovery on the Northern Terrace.

IRAN



Iranian Oil Minister Bijan Zanganeh has enthusiastically reported the discovery of a significant additional oil pool

below a 1966 oil discovery that was brought onstream in 1971. According to the minister, 5.7 billion barrels of oil in place have been indicated in the Ramin oil field and recoverable reserves have been estimated at 855 MMbo from four reservoirs. The field currently produces around 2,000 b/d from the Asmari Formation, but with the new deeper pool, assumed to be the Middle Cretaceous Sarvak Formation, output should increase to 80,000 to 90,000 b/d. The results are presumably from NIOC's second sidetrack in the Ramin 7 appraisal, which was kicked-off from 4,100m and reached a total depth of 5,370m and which has been under test since August 2004. The Ramin oil field is located in the Khuzestan Province, Zagros Fold Belt. The 1966 discovery well flowed 1,000 bo/d of 33.7° API crude from the Asmari Formation. Following the results of the latest well, gas reserves have been revised to 8.5 Tcf, with around 1.2 Tcf recoverable.

IRAQ



Conducting business development activities in Iraq since 2003, Gulfsands Petroleum has signed a Memorandum of Understanding with Iraq's Ministry of Oil in Baghdad for the Misan Gas Project in southern Iraq. The aim of the project is to gather, process and transmit associated gas from a number of producing fields in the Zagros Fold Belt, southern Iraq, with the objective of eliminating gas flaring, currently the practice in a number of large field, and produce a resource that can be used to generate electricity for domestic use. This is a two-phase project of which the first phase is expected to take around three years to complete and the second phase, a further two years. Production capacity from the project is expected to reach about 46,600 b/d of NGL and 338 MMcf of dry sweet natural gas per day. Gulfsands is intending to float on the US stock exchange to raise approximately US\$ 25 million net of expenses.

PAKISTAN



A Middle Indus Basin appraisal well has been re-entered by Rally Energy and tested in the Cretaceous Lower Goru Formation for 5 MMcf/d and 22 b/d of API 43° condensate. Rodho 3 (Dewan 1) reached a total depth of 2,758m in the Cretaceous Sembar Formation in early February. Two cased-hole drillstem tests were conducted on a one-inch choke in over four prospective gas-bearing intervals. Significant formation damage has been identified and fracturing should result in increased flow rates. Gross structural gas column is 170m. With an aerial extent of approximately 14 sq km with a maximum vertical closure of over 450m, the discovery has highlighted the exploration potential of two further structures with significant aerial extent on the acreage. The most notable is the Afiband structure some 4km

south of Rodho, which has an aerial extent of approximately 50 sq km and a vertical closure of approximately 300m at depths comparable to the encountered Rodho formations. Rally is now investigating the technical feasibility of deepening the Rodho 2 discovery for further appraisal of the Lower Goru Formation. That re-entry also tested the deeper Jurassic Chiltan Formation.

Two offshore blocks in the Indus Delta have been awarded to ENI under Production Sharing Agreement (PSA) terms. Offshore Indus-M 2366-4 EL (2,495.17 sq km) and Offshore Indus-N 2366-5 EL (2,498.28 sq km) are 75km and 150km, respectively, south-west of Karachi. Water depths in the former range up to 200m, while the latter is in water as deep as 1,000m. The acreage is north-east of Shell's Offshore Indus-E EL. ENI plans to spend a total of US\$ 16 million during the initial three-year exploration phase of the blocks.

An appraisal of a 2002 discovery in the Sinjoro Exploration License in the Lower Indus Basin has been tested by OGDC flowing 3 MMcf/d and 145 bc/d. Chak 2-3 was suspended in mid-February 2005 at a total depth of 3,158m in the Cretaceous Lower Goru Formation. It is the second appraisal of Chak 2-1, a 3,050m well that was completed in August 2002 flowing 10.8 MMcf/d and 425 b/d of 50.7° API condensate. The first appraisal, Chak 2-2, was successfully completed at a total depth of 3,420m in August 2004.

QATAR



There is further evidence pointing to the strengthening of interest in Middle Eastern LNG with both ExxonMobil and Shell signing deals with Qatar worth a combined US\$ 19 billion. The deal with ExxonMobil is valued at US\$ 12.8 billion and allows for 17.2 million tons of exports to the United Kingdom for 25 years commencing in late 2007 from Qatargas 2. This project is described as the world's largest LNG development effort and this announcement coincides with the stone laying to mark its commencement (see below). The deal with Shell is a Heads of Agreement for the development of a large-scale LNG project located in Ras Laffan City that is to be known as Qatargas 4. This project comprises the integrated development of upstream gas production facilities to produce 1.4 bcf/d and substantial quantities of associated liquids from Qatar's North field, a single LNG train yielding approximately 7.8 million tons per annum of LNG for a period of 25 years, and shipping of the LNG to the intended markets in North America and Europe. Qatargas 4 is a joint venture between Qatar Petroleum and Shell with 70% and 30% equity interests respectively. LNG deliveries are expected to commence around 2010-2012.

At the beginning of March 2005, Qatar Petroleum (QP) signed a DPSA with India's ONGC Videsh Limited (OVL) to appraise and develop the Najwat Najeem oil field and explore the 120 sq km sector of Block 8 offshore Qatar otherwise designated as the Najwat Najeem Oil Structure area. Subject to the results of an initial two-year work

program of technical studies, seismic reprocessing and appraisal drilling, the agreement may be converted to a full development of the Najwat Najeem structure. Devon Energy, which had held a 75% interest and was formerly the block's operator, announced its withdrawal from the concession during mid-February 2002. It is understood that following Devon's departure, previous partner Novus tried to renew or retain the license in order to develop the marginal Najwat Najeem oil field, but that the Qatari authorities felt unable to offer terms that made the development attractive as a stand-alone proposition. The discovery well tested 2,000 b/d of 29° API oil from the Upper Jurassic Arab Formation. This award signals OVL's first operatorship in the Gulf.

SYRIA



US independent explorer Devon Energy has announced that it is quitting operations in Syria, blaming US sanctions imposed on the Middle Eastern country in 2004 which it believes has created "obstacles" to doing business there. Devon explains that although the current sanctions do not prohibit Devon from doing business in Syria, they have had an impact on the availability of support services, an example of which has been the exclusion of using certain types of US-made technical equipment that are key to its operations. The company has informed the authorities that it is looking to find a buyer for its 80% stake in its Block 26 Production Sharing Contract. Block 26 was awarded to Devon and Gulfsands (20%) in August 2003 for an initial exploration phase of four years in which there was an obligation to drill four wells, reprocess existing seismic and acquire new seismic data. Total financial commitment for the contract was US\$ 17 million, including a US\$ 1 million signature bonus. The block is located in the Sinjar Trough, north-east Syria and comprises three blocks covering a total area of around 8,810 sq km in parts of the Kamishli Uplift and the Sinjar-Abdul Aziz Uplift.

The Syrian Ministry of Petroleum and Mineral Resources (MOPMR), state oil company SPC and InSeisTerra of Norway have signed a 10-year exclusive contract to acquire, process and interpret non-exclusive seismic data from areas in the Mediterranean Sea offshore Syria. The program is scheduled to begin around 1 May 2005 with a 5,000km 2D survey covering the entire Syrian offshore sector. InSeisTerra will also handle and be responsible for the marketing and licensing of the geophysical data to the international oil industry. The new 2D survey will be used for evaluating the Syrian offshore acreage prior to the first offshore licensing round for which an announcement is expected one year after the data is available, presumably around 3rd Qtr. '06. In the latter part of 2004, Veritas DGC cancelled an offshore 2D survey due to political difficulties caused by sanctions placed on Syria by the US.

The Ministry of Petroleum and Mineral Resources (MOPMR) is making the final preparations for a fifth oil and gas exploration licensing round. The round is expected to be launched within three months and include

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nine blocks, although this may change significantly as it is dependent upon the outcome of negotiations on the blocks offered in the previous round. A total of 14 blocks, covering 88,980 sq km, were offered in the fourth licensing round, which was launched in January 2004, but no bids were received for the six blocks: V, VII, IX, XV, XVI, XIX and XXI. The licenses to be offered in the proposed round are to be offered with more flexible investment terms and production sharing agreements will be more generous in an effort to create greater industry interest.

YEMEN



Holding a 25% interest in Block S-1 operated by Vintage, TransGlobe Energy has provided an update on the Malaki 1 well. The well was testing a structure located 8km south-east of the An Nagyah oil field and sought a similar primary objective, the Upper Jurassic Lam member

clastics of the Madbi Formation. At the end of February 2005, the well had reached a total depth of 2,315m and was being abandoned after encountering minor hydrocarbon shows. The Lam "A" sandstone was found to be structurally lower than the OWC in the An Nagyah field and proved to be water saturated.

Total has spudded its fourth basement appraisal in the 1,060 sq km East Shabwah Block 10 (Development Area), after testing its third such well for 6,500 bo/d. Kharir 404A follows Kharir 403A, which has been tied into production facilities. That well reached a total depth of 3,383m in January 2005. Meanwhile, its predecessor, Total's Kharir 402A, was producing 710 bo/d at last report. The company's first vertical basement well -- Kharir 401A -- was completed as an oil producer in October 2004. Total's drilling program is based on the reprocessing of existing 2D and 3D seismic. Partners include Comeco (SOCO), Occidental and Kufpec.

With thanks to IHS Energy

For further information please contact
Ken White or Stuart Lewis
 e-mail : ken.white@ihsenergy.com
 e-mail : stuart.lewis@ihsenergy.com
 web site : www.ihsenergy.com



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GSO EVENTS CALENDAR

2005

MARCH

3rd GSO Field Trip (3rd March 2005)

Dr. John Aitken

Geology of the Ordovician Amdeh Formation
 Badley Ashton

4th GSO Field Trip (16-18 Mar 2005)

Dr. Alan Heward

Geology of the Saiwan Area, Northern Huqf

11th GSO (Jointly with SPE) Talk (22 Mar 2005)

Dr. Alan Heward

The Search for Petroleum in Oman - The first 100 Years!
 PDO

12th GSO Talk (27th Mar 2005)

Prof. Harald G. Dill

"Solutions to the E & E Issue"

Federal Institute for Geoscience and Natural Resources, Germany

5th GSO Field Trip (31st Mar 2005)

Prof. Hugh Rollinson

Wadi Hamaliya Ophiolite Excursion
 Sultan Qaboos University

APRIL

13th GSO Talk (19th Apr 2005)

Dr. Jean Paul Breton

"Upper Cretaceous destruction of the North Oman margin"
 Office of Geological and Mining Research - France

6th GSO Field Trip (21-22 Apr 2005)

Dr. Jean Paul Breton

From Subduction to Exhumation - Two days tectonic and metamorphic transect from Tanuf to Sifa
 Office of Geological and Mining Research - France

MAY

14th GSO Talk (1st May 2005)

Dr. AbdulNasser Darkal

General aspects of the main structural units in the northern part of the Arabian Plate
 Sultan Qaboos University

Annual GSO Meeting

31st May 2005



Dr John Hurst,
Novus Exploration Manager
Middle East



Peter Sadler,
Regional Manager,
Medco West Asia

Novus EPSA and Middle East History

1995

- ▶ Block 8-Acquisition of 10% equity from IPO

1997

- ▶ Block 8-Acquisition of additional 30% equity and operatorship from IPC (Lundin)

1999

- ▶ Block 17-Concession signed

2001

- ▶ Block 15/47-Concessions signed

2000

- ▶ Block 8-3D Seismic Acquisition Tibat 2002
- ▶ Onshore RAK-Concession signed
- ▶ Block 31-Concession signed
- ▶ Block 8-Tibat-1 Exploration Well (sub-commercial gas and oil discovery)

- ▶ Onshore RAK-2D Seismic Acquisition
- ▶ Blocks 15, 47-2D Seismic Acquisition
- ▶ Block 31-2D Seismic Acquisition
- ▶ Block 15-Relinquishment

Novus Oman Ltd ('Novus') is an oil and gas subsidiary of PT. Medco Energi with exploration and production interests in the UAE and Oman.



EPSA and History

Since 1995 Novus has been present in the Arabian Gulf and as operator since 1997. Over the past 5 years Novus has specifically targeted acreage in gas-condensate (Figure 1). Currently this acreage is held 100% by Novus. Novus is also the operator of Oman's only offshore production from the Bukha field in Block 8.

Strategy and Future

"Novus has always been a strong believer in the UAE and Oman. We will continue to be focused on exploration and development of gas and gas-condensates in Northern Oman and UAE. We do not intend to get involved in downstream activities. We believe we should stick to the part of the energy business we know well and where our skills lie.

Since 1999 Novus has spent \$20MM on exploration in Blocks 17, 31 and 47. We are ready for drilling in 2006 and several others prospects are candidates for additional or original 2D seismic surveys."

'Combining our local geological knowledge with the experience we have gained through the operatorship of the Bukha field has led Novus to build a substantial acreage position in Oman. Fields rarely occur singly, and once the geological conditions that work are identified exploration becomes a matter of seeking other areas where those conditions are replicated. In this instance we have recognised that the Bukha and Hengam fields share many similarities that can also be seen in other discoveries in the southern mountain range in Oman. We believe that there is an extensive play system that runs along the length of the buried thrustbelt; wherever structure can be found there is a good chance of finding reservoir, gas and condensate.

The underlying themes of the play set are:

- ▶ Regionally proven reservoirs (Natih, Shuaiba, Khuff, Amin)
- ▶ Proximal foreland basin and fold belt setting with large anticlinal closures
- ▶ Nearby working analogues.
- ▶ Significant size (0.5 Tscf to 2 Tscf).
- ▶ Prospects close to infra-structure and growing gas market.

This entire system covering many blocks, is referred to by Novus as the North Arabian Gas-Condensate Play (NAGP) fairway. We are hopeful that our reputation will precede us as we expand.'