

The Oil Drop e-Newsletter

Issue # 2

22 December 2016

An electronic newsletter designed to update members with the latest news and events of the society and to raise technical and professional awareness.

Dinner and Technical Luncheon Meetings

Local and world renowned scientists and professionals are regularly invited to present their work at DGS events as part of the society's mission to expand the knowledge of its members in the geosciences. Four technical meetings held over the past few months have opened the minds of the many attendees to a wide variety of exciting topics, from time-lapse full waveform inversion (FWI) through to Red Sea geology and the challenges faced with land seismic acquisition.

During the first DGS technical luncheon of the year (30th August), highly regarded geophysicist Biondo Biondi, professor of Geophysics at Stanford University, gave a thought-provoking talk on "Time-Lapse FWI with Application to Geomechanical Monitoring". Professor Biondi, who is also the director of the Stanford Exploration Project (SEP), has made a significant contribution to the field of seismic imaging including velocity estimation and parallel algorithms for seismic migration. His presentation on FWI for 4D seismic was a look into the future, with the method inverting multiple surveys at the same time with the aim of detecting small changes caused by reservoir production. Although the technique has only been tested on synthetic data at present, the potential will increase overtime as the use of time-lapse seismic becomes more widespread.

Le Meridian Hotel in Khobar played host to the second event of the year on 25th October 2016, with Mr. Ali Al-Maashi of SABIC invited as the guest speaker for the evening. Mr. Maashi, Head of the Global Future Business Unit at one of the world's largest petrochemical manufacturers for the past three years, shared his views and experience on the so called "Age of Plastics". He has a wealth of experience in the industry of turning petroleum into useful industrial products, which includes holding the position of director of corporate sustainability for more than five years.

The challenges faced by land seismic acquisition, a very relevant topic here in Saudi Arabia, was the focus of the DGS technical luncheon held at the end of October. SEG Honorary Lecturer Mr. Said Mahrooqi, who is currently the head of Geophysical Operations at Petroleum Development Oman LLC (PDO), was the special guest for the event which was well attended and received by more than 120 people from the oil industry, Saudi Aramco and KFUPM. Mr. Mahrooqi, who obtained his BSc degree in geological science from San Diego State University and an MSc degree in exploration geophysics from Leeds University, has a wealth of experience in the field of seismic acquisition. His work experience includes land and marine seismic acquisition, VSP, micro-seismic, and non-seismic techniques. An interesting and informative talk titled "Land Seismic Acquisition – The Highs and Lows of Very High Data Rates and Very Low Frequencies" was heard over a delicious lunch.

One of the latest event of the year saw Dr. Abdulkader Afifi, a senior geologist at Saudi Aramco, deliver an excellent insight into the geology of the Red Sea. This is an area of increasing importance as exploration starts to focus on the western coast of the peninsula. His career started back in 1980 with the US Geological Survey (USGS), where he worked on geological mapping and mineral exploration in the Mahd Adh Dhahab mine area. Dr. Afifi then joined Saudi Aramco in 1991 and has since held various technical and management positions within the Exploration Organization, including responsibility for a number of key technical projects for oil and gas exploration. Dr. Afifi holds a PhD degree in geology from the University of Michigan, a Masters from Colorado School of Mines and a Bachelors from KFUPM.



Prof. Biondo L. Biondi describing the potential use of FWI for time-lapse seismic at the first DGS technical luncheon of the year



Mr. Ibraheem Assaad, Mr. Ali Al-Maashi and Dr. Mohammed Alhussain



Mr. Said Mahrooqi, head of geophysical operations at PDO, shared his experience in the field of land seismic acquisition



Watch out for emails about future technical luncheon and dinner events, as registration is required and space is limited. Don't miss out on this opportunity to hear from some of the experts in the field of geoscience!

Dr. Abdulkader Affi gives the audience an insight into geological features of the Red Sea



DGS Sponsored Course: SEG Distinguished Instructor Short Course (DISC): 3C Seismic and VSP: Converted Waves and Vector Wavefield Applications by James Gaiser



DGS sponsored the SEG distinguished instructor short course (DISC) given by James Gaiser, which was held on 30 November 2016 at the Carlton Al Moabed Hotel. The course, which was attended by 44 participants, provided an overview of three component (3C) seismic theory and practical application: from fundamentals of PS-waves and VSPs, through to acquisition and processing including interpretation techniques. The emphasis was on unique aspects of vector wavefields, anisotropy, and the important relationships that unify S-waves and P-waves. Various applications and case studies were demonstrated such as image benefits from PS-waves, elastic properties from joint inversion of amplitude variations with offset/angle (AVO/A), and VSP seismic methods for improved reservoir characterization.



Students Outreach : King Abdulaziz and His Companions Foundation for Giftedness and Creativity

King Abdulaziz and His Companions Foundation for Giftedness and Creativity (Mawhiba), is a national cultural foundation that is presided over by the custodian of the two holy mosques. Mawhiba focuses mainly on science, technology, leadership initiatives and management. The foundation paves the way towards a knowledge-based society, supports a national culture of innovation and promotes the success of various national plans and projects. DGS took the initiative to pay Mawhiba a visit to introduce itself to over 200 gifted students as a nonprofit organization encompassing geology, geophysics and related geosciences.



DGS president Mohammed Alhussain introduced the students to the main mission of the society, which is to provide technical and professional development for its members in the domain of exploration and development of petroleum and mineral resources within Saudi Arabia. DGS highlighted its program and activities throughout the year, which includes regular dinner and technical luncheons where experts are invited to give keynote talks. Also, examples of past and future field trips organized yearly inside and outside of the Kingdom as part of the outreach program were shown, to expose young students to the hidden treasures of the kingdom and attract more of them to join these fun and educational trips. Furthermore, DGS also presented special events and programs designed by and for young professionals fulfilling young talents' aspirations. For those that are looking to specialize in geosciences and improve their knowledge, DGS highlighted their educational days and international Distinguished Lecture Programs (DLP) and co-organizes student symposiums.

Tanzania Safari Trip : "Discover the land of Kilimanjaro" Led by Mr. Saidi Hassani, Exploration Geologist, Saudi Aramco

In mid-September, a group of adventurous DGS members flew to Kilimanjaro International Airport in Tanzania, and were treated to the magnificent view of the snowcapped peak of the majestic Mt. Kilimanjaro. Kilimanjaro is the highest point in Africa and the tallest freestanding volcanic mountain in the world. During the weeklong safari trip organized by the DGS, participants explored a wide array of environments, from the grasslands and savannahs of the Serengeti Plain (the dream of Africa), to the world's largest unbroken volcanic caldera (Ngorongoro crater) and unique ecosystems of Lake Ndutu.

After spending the first night at a luxurious lodge located by the spectacular volcanic Crater lake near Mount Meru, the group commenced the safari adventure in open top four wheel drive vehicles, passing numerous majestic baobab trees on the way to Lake Manyara National Park. Lake Manyara lies

within the Great East African rift valley, which was formed by tectonic forces pulling apart the African and Arabian plates and stretches around 8700 kilometers from Mozambique in the south to Syria in the north. The rift is still seismically active and is associated with numerous volcanic mountains and small shallow soda or alkaline lakes including Lake Manyara; a delightful and interesting forested park. A short stop was made at the rift escarpment viewpoint overlooking the lake. Although the lake is small, it is one of the most beautiful and rich parks in Tanzania which is well known for its tree climbing lions. The lake is also a great sight for bird viewing at the hot springs populated with pink flamingos and other bird species.

The trip continued to Ngorongoro Crater and conservatory for two days exploring its volcanic crater. Formed by geological upheavals, this crater was once as high as Kilimanjaro mountain until it blew up around three million years ago, covering the Serengeti in ash. The crater floor sank leaving the rim to form a high natural enclosure. This is the best self-contained safari destination in the world. In fact, it is the world's largest unbroken volcanic caldera, the eighth wonder of the world, which is referred to as the Garden of Eden. The crater is home to over 20,000 large animals including some of Tanzania's last remaining black rhinos. On the second day, the group had an early start to descend the crater and had ample of time to observe at close hand the animals in the crater, including a sighting of a black rhino grazing along the river bank.

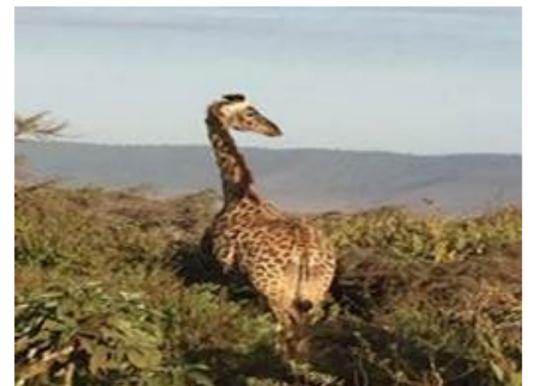
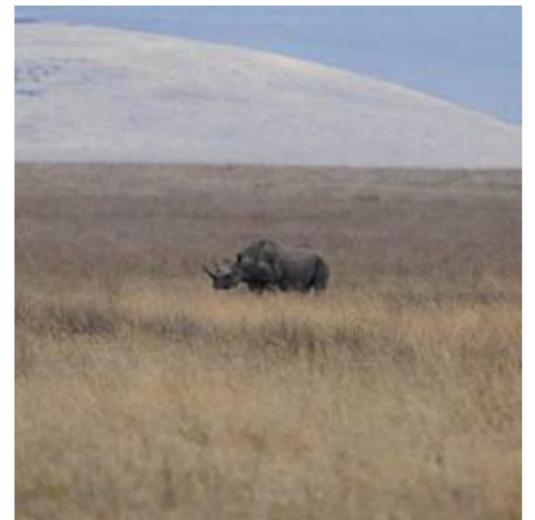
Next the group headed towards Serengeti National Park via Olduvai Gorge. The Olduvai is an archeological and anthropological site in the eastern Serengeti Plains where Mary Leakey discovered the Zinjanthropus (early hominid) skull, which dates back 2.1 million years ago. The group visited the museum located at the top of the gorge and attended a lecture about the Olduvai Gorge. Various ancient fossils, fauna, artifacts including tools and made sure that everybody left their footprints for the next generation to witness their presence. The group also visited the black volcanic shifting sand dunes, which were blown from the neighboring erupted volcanoes.

Later on, the group proceeded to the grasslands and savannahs of the Serengeti Plain. Serengeti is considered to be one of the finest game reserves in the world and is the site of many wildlife documentaries who come to observe one of the greatest spectacles on earth, where the Great Migration of more than two million animals move clockwise around this ecosystem in search of grazing land and water. The group had two full days of driving and admiring all sorts of wildlife animals such as buffalos elephants, giraffes, impala, hippos, including all the big predators (lions, leopards and cheetahs) follow wildebeests and zebras closely. The group viewed numerous large and small bird fleets including ostriches and huge crowned eagle flying overhead. Sometimes, the lions would come close to tourists vehicles for shade. The group witnessed the mating season and animal fights; and were so lucky in one incident to witness a lioness hunting a zebra and just before she could start eating a male lion came and chased the lioness away after all the hunting hard work, a real life thrilling action!

The highlight of the trip was undoubtedly spotting a leopard climbing up a tree, which was the highlight of this trip because leopards are known to be shy animals and hard to spot. Later on at the Serengeti visiting center, there is a replica of the pride rock similar to the one in the lion king movie. Evenings were relaxing watching the bright red African sunset at the lodge, enjoying the spas, a variety of cuisines for dinner and cultural entertainment. The second day at the Serengeti some of the group members opted to go on a hot air balloon ride in the early morning where they saw beautiful Serengeti landscape across the plain from above; they also saw kopjes (granite inselbergs) scattered all over Serengeti Plain. They were also witness to a pride of lioness' and cubs feasting on a hippo at the swamp and they even had an opportunity to view a leopard bring down a gazelle and grab it by her powerful jaw. It was the most exciting show of the hot air balloon flight as if they did not see enough wildlife on the ground.

After two nights at Serengeti, the group drove back to the southern part of Serengeti ecosystem and stopped over at Lake Ndutu where they spent the last night of the safari trip at the shaded lodge. The lodge is surrounded by majestic indigenous acacia trees and shrubs, which encourage a host of birds and mammals to come right to the front door. Tucked well away from the busy touristic sights, Ndutu offers peace and tranquility far from the madding crowd. The group had dinner by the bonfire and gazed at stars under the open sky. The following morning after breakfast, the group drove to Arusha for a good night of rest and dust off at one of its finest hotels. On the way back, the group shopped at local art galleries where they bought souvenirs for family and friends. Of course, some people made sure to purchase beautiful Tanzanite gemstones to add to their jewelry collection. Tanzanite is a unique stone only found in Tanzania. This was the most memorable and adventurous trip. The trip participants were the ones who made this trip be joyful and fun! Thanks to DGS for organizing it. This article is written by Saidi Hassani.

Look out for announced details of future trips, both in and outside the Kingdom, in the DGS website!





On a bright Saturday morning on 22 October 2016, a group of 35 budding geoscientists took a tour back through time, to rediscover the history and geology of the area in which we live – the Dammam Dome. The event that led to this rediscovery, a field trip to the Dammam Dome, was sponsored by the Dhahran Geoscience Society and began at a historic site – the discovery well for the Dammam field, Dammam #7 – where oil was first discovered in Saudi Arabia (Figure 1). Participants heard the story of the discovery of oil at this location, and understood how a few of the early geologists, using good geologic reasoning and a minimum of data, were able to piece together an understanding of the subsurface that ultimately allowed them to discover the world’s most prolific reservoir interval, the Arab Formation. The present-day affluence and influence of Saudi Arabia on the world stage can be traced in large part to the success of those early pioneers at that location.

After reviewing the history of the discovery of oil at Dammam #7, field trip participants then took a trip back through geologic time, to explore the geology of the Dammam Dome; during this visit, they were able to see how this special feature formed and the rocks that comprise its surface expression. The Dammam Dome is an oval-shaped, salt-cured structure about 15 km long along its major NW-SE axis, covers an area of about 155 km², and is characterized by the presence of a well-developed system of fractures that are at times spectacularly solution-enlarged. It is the effects of solution – and subsequent re-precipitation of calcite cements – that represent some of the most impressive features of the Dome. Millennia of exposure to meteoric fluids (also known as rain water) along the surface of the Dome has led not only to enlargement of fracture apertures but also to a large degree of vugginess overall in the rocks that comprise the Dome at the surface. Multiple generations of cements, locally interspersed with sediment-fills, fill and void space created along fractures and by leaching of soluble minerals in the surface rocks.



The Dammam #7 wellhead and commemorative plaque.



Fracture filled by multiple generations of cement and sediment.

Field trip participants also learned about the two main geologic formations that are exposed on the Dome, the early Eocene-age Rus Formation and the middle Miocene-age Dam Formation; these two very different successions are separated by a spectacular un-conformity, the Pre-Neogene Unconformity (PNU), a hiatal surface that represents roughly 40 my of missing time. The Rus was seen to comprise highly cyclic and evaporitic carbonates that overall recorded an upward shoaling sequence and culminated with (now largely solution collapsed) evaporates interpreted to have been deposited in a sabkha; these carbonates were thought to have been deposited during a time of almost unprecedented warmth on planet Earth – a time of global greenhouse climatic conditions. Immediately overlying the Rus is the very thickly bedded and non-evaporitic Dam Formation that contains a very diverse normal marine fauna; this interval has been interpreted to have formed during much cooler climatic and less evaporitic conditions, a time of global transition to the icehouse conditions that prevail on our planet today.

Perhaps the highlight of the geologic portion of the trip was the opportunity to examine the unconformity separating these very different formations, the PNU (Figure 3). This surface contains highly variable amounts of breccia (thicknesses ranging from almost 0 to 3 meters) that are thought to reflect varying amounts of breccia accumulation along a highly rugose erosional surface. Breccia clasts were polymictic in nature and included frequently lithophagid bored rip-ups from the underlying Rus, as well as a variety of silicified rock fragments. After this action-packed geologic and historic adventure, all field trip participants were treated to a well-earned lunch at the Dhahran International Hotel by DGS.



A detailed view the PNU (red dashed line), showing breccia fragments (arrows) and the contrasting textures of the Rus below and the Dam above.

I greatly appreciate the assistance of co-field trip leader Rainer Zuhlke, of Saudi Aramco’s Public Relations Department for allowing access to the Dammam #7 wellhead, to Industrial Security for providing security for the trip, to Indra Boana for the photos used in this article, and to all the folks on the DGS Executive Committee (especially Yasmina Kechida) for making this trip happen. This article was written by Dr. Dave Cantrell.



Running for Wellness : An Inspiring Weight Loss Story

Increasingly, runners around the world use the sport to not only shed a couple of excess pounds, but to start their day with a bright beginning; a day fueled with energy and a positive mood toward life. Mohammed Alsarraj, a competitive runner and geoscientist in the reservoir characterization department, volunteered to share his story with DGS. Thirteen years ago, Mohammed started his weight loss journey trying many diets, but only succeeded in losing a few pounds, only to later regain them again. The story changed dramatically three years ago when Mohammed was introduced to racing by coach Abdulaziz Almoqbel, who invited him to join his running group known as the "Wellness Running Group". The impact of running on Mohammed's life motivated him more. He said, "running requires a high commitment but it's highly rewarding. Seeing the results of running pushed me to continue." To him, running started as a healthy practice to lose weight, but with time it developed to be a social activity where he meets people who share the same interest and experience. Then it became a habit and passion that he enjoys, giving him reason to participate in more races. For Mohammed, racing is an important tool to measure your fitness level and where you stand in the crowd. Also, it is a motivational way to keep focused on his training. Running has changed his life in many aspects, particularly physically where he managed to lose 50 kilograms of weight and transform himself from an obese to fit person. Mentally, running taught him that if there is a will, there is a way.

Since he joined the running group, Mohammed has participated in many races, varying in distance from 1 kilometer to a full marathon of 42.2 kilometers. Some of the major local and international races he has participated in include: the Dammam Charity 5 kilometer race (2014), the Ras Tanura half marathon (2014 and 2015), the Bahrain marathon relay (2014 and 2015) and the Standard Chartered Dubai 10 kilometers (2014). He even participated in the Tour of Dhahran Races in 2014 and 2015, which constitutes six races over a period of seven days. His participation in running a marathon race was an inspiration to people around him to start running and set their own racing goals.

As part of DGS-YP section activities, a wellness program was initiated for beginner runners with coach Abdulaziz Almoqbel. The aim is to teach running the smart way with a few secrets to staying injury-free and enjoying lifelong lessons on how to work on personal goals of fitness and wellbeing. Participating runners are also taught methods to build their own running programs that suite their expectations. Consistency is the key to prolonged fitness, investing in running teaches a person how to maintain the momentum from one run to another for consistent progression. With that, a runner will be well equipped and qualified to join DGS planned running races in collaboration with the Dhahran Road Runners Club. Training sessions are held twice a week on Mondays and Wednesdays, starting from the first week of November.



October Health Awareness : Breast Cancer Awareness Campaign in Collaboration with Johns Hopkins Aramco Healthcare

Every year in the month of October, the whole world participates in raising awareness of breast cancer through public campaigns. DGS Young Professionals section pledged to fulfil the duty to this noble cause and helped bring the JHAH-organized 'Think Pink' campaign trail to Dhahran's core area to help raise awareness of breast cancer among employees. The campaign was supervised by distinguished doctors from Johns Hopkins Aramco Healthcare (JHAH) and included a half day booth session at EXPEC basement of Dhahran's core area on the 6th of October, and an informative lecture on the 13th of October that helped answer important question about breast cancer. The booth welcomed around 165 visitors and the majority were satisfied with their questions being answered. It was a surprise for many male visitors to know that breast cancer can occur in male patients too. Overall, it was a successful campaign and counts as a great beginning for few more medical awareness campaigns in the future.



Social Activity : The Secret Room

As a part of the DGS Young Professionals section social activities, members were offered the chance to participate in the secret room game on the 11th and 12th of October. The secret room is an interactive game designed to allow players to solve difficult challenges in order to escape from the room within 60 minutes. DGS members who participated in this event were divided into two teams, trying to solve two different mysteries. The challenges players faced were purely dependent on teamwork and quick responses in connecting each riddle to the other, building up a stream of thoughts that lead to the door key, the only way out by the end of the game. Both teams did a great job and managed to escape before the time limit. Firas Awam, a DGS member commented on the game saying: "It was a great experience! I never imagined 1 hour would pass this fast. I highly recommend this activity for my peers." Another participant had commented that the game was well organized and he cannot wait to bring the rest of his family to try solving the other mysteries the facility offers.



Membership Update

Membership of the Dhahran Geoscience Society is open to all Eastern Province geoscientists. The Dhahran Geoscience Society is an affiliated society of AAPG, EAGE & SEG. If you are interested in joining DGS, please complete the online application form at <http://dgsonline.org/register>. If you are already registered, please update your contact information at <http://dgsonline.org/profile>. For more enquiries about membership, please contact the membership liaison:

| Location | Name | Phone | Office | Email |
|--|----------------|------------------|-----------------|--|
| EXPEC I, Saudi Aramco Core Area, Dhahran | Mai Al-Mansour | +966 13 873-6950 | X-2445, Floor 2 | membership@dgsonline.org |

Upcoming Events, Announcements & Important Dates

| | |
|--|------------------|
| January Dinner Meeting : Mr. William Abriel, SEG President | 10 January 2017 |
| DRRC Peninsula 10Km Running Race with DRRC | 13 January 2017 |
| AAPG Distinguished Lecturer David Wagner | February 2017 |
| SEG/DGS Middle East Challenge Bowl Competition | 27 February 2017 |
| Al Hasa Safari Trip | To Be Announced |

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