**SPWLA INDIA CHAPTER**

**Annual Activities (2023-24)**

SPWLA INDIA chapter had an eventful year (2023-24), starting the year with 5th SPWLA India Symposium-2023 followed by numerous technical workshops, seminars, and geological field trip aimed at knowledge sharing and professional development. The chapter has been vibrant with numerous activities designed to advance our professional knowledge, foster collaboration, and promote petrophysics.

The membership of the SPWLA India Chapter is the cornerstone of our vibrant community. This year, we have experienced a remarkable growth in our membership base, welcoming a diverse group of professionals, students, and industry experts dedicated to advancing the field of petrophysics.

### Executive Members of SPWLA INDIA CHAPTER

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SPWLA India Chapter organizes a Geological Field Trip – A Tryst with Deccan Volcanism – for its Members

It was an altogether different experience for the petrophysicists and logging engineers of Mumbai when they undertook a one day geological field trip under the auspices of SPWLA India chapter, on the 24th of February 2024. The field trip, covering volcanic and volcaniclastic exposures and outcrops along the suburbs of Mumbai, was arranged with the help of Department of Earth sciences, IIT Bombay. Dr Hetu Sheth, professor of igneous petrology and volcanology at IITB, along with Dr Amol Naik, a post-doctoral research scholar, lead the team of 30 odd members on a magnificent journey where events dating back to ~65 million years were explained with the help of present day remnants preserved by Mother Nature. The geology of Mumbai is predominantly volcanic, with mafic (basalt, dolerite), intermediate (andesite) and felsic (rhyolite) products co-existing on the seven islands that are linked together by reclaimed land. The sites for the field work were so chosen that a few of these important rock cut exposures or outcrops could be covered in a day. The participants were all eyes and ears as the Professor explained in detail the Deccan continental flood basalt (CFB) volcanism and Western offshore basin formation. The field trip began at the Sanjay Gandhi National Park which houses the famous Buddhist heritage site of Kanheri caves. Units of pillow lava in the form of lobes and tubes resembling giant ginger rhizomes are exposed in the dry bed of the Dahisar River, within the park. “These pillow lavas were formed during the late stage of Deccan volcanism in a subaqueous effusive phase”, explains Dr Sheth. He went on to explain how the pillows with smooth surfaces branch out by interconnecting pillow tubes which are fed by large pillow lobes. The pillow lava exposure at SGNP could serve well as a geo-heritage site as not many occurrences of pillow lavas are recorded in CFB provinces.

The pillow lavas are conformably overlain by a ~160m thick volcaniclastic rocks of Kanheri, further above in the SGNP campus. These subaqueous erupted pyroclastic rock units are home to a number of rock-cut caves and monuments that were excavated from 3rd to 11th century AD. The faculty members explained the nitty-gritty of pyroclastic units within the rock-cut caves and structures by showing the grain size classification of ash, lapilli, blocks and bombs in the increasing order of size. Cutting across the pyroclastic sequence, the team could witness curvi-linear dykes or lava sheets.
A short trek downhill, the team could witness outcrops of basaltic rocks where secondary mineralization in cavities were observed. A massive dolerite dyke within an essentially trachyte province was another stop-over inside the national park.
From SGNP, the team proceeded to Uttan-Dongri area where abandoned quarries had exposures of columnar jointed rhyolites and volcanic ash deposits. Dr Sheth explained in detail to the queries raised by young geoscientists regarding the compositional aspects and cooling rates of basalt, rhyolite and trachyte. He further demonstrated how it is possible to measure the flow dips (lava) from the dips of the well-developed columns of rhyolites.

For the participants, the knowledge gained in the process was invaluable and were able to relate it to the work they were doing day in and day out with the electro logs of Western offshore Assets and Basin. The field trip ended on a positive note to explore further as learning is always a continuous process.

Earlier in the day, ED-Chief Logging Services and President, SPWLA India chapter Shri. SK Singhal flagged off the field trip from 11 High, ONGC Campus. Taking the initiative in organizing the field trip, he reiterated the need for getting field acquaintance for geoscientists as any interpretation should explain a geological condition. Thanking profusely the faculty members from IITB, he acknowledged their support in making the field trip interactive and also handed over participation certificates to the members at the end of the trip.
SPWLA INDIA Chapter Technical Session conducted on 23.02.2024 at Mumbai, INDIA

SPWLA INDIA Chapter organized a technical session covering two presentations for the benefit of its members at Mumbai on 23.02.2024. President of the chapter Mr. S K Singhal welcomed the gathering following which, Mr. Kuldeep Singh Chib, Joint Secretary (Education), gave a short brief on the two topics. The session was attended by 50+ petrophysicists and logging engineers. A brief write-up of the technical presentations and authors are mentioned below:

**Value addition using Pulsed Neutron Technology:** presented by Nishi Chauhan, Technical Solution Advisor (Geoscience), M/s HLSA

The study presented case studies for maximizing the hydrocarbon recovery based on standalone formation fluid identification using multi-detector pulsed neutron tool. The author, with the help of case studies, brought forth the importance of cased-hole PNL as the best suitable technology for brown fields. Pulsed-neutron tool with three detectors can provide three-phase formation fluid analysis in cased wells, provide clear idea of formation fluid, hydrocarbon quantification, porosity calculation and lithology identification. Case Studies from Frontier Basin and Mumbai Offshore Basin were presented, in which RMT aided in significant oil and gas gain.

**An Integrated Approach for Variable ‘m’ calculation and T-2 cut-off for Low Resistivity Carbonates:** presented by Nishant Pandey, Suptdg. Geophysicist(wells), CEWELL, ONGC

A novel approach adopted for petrofacies based ‘m’ regression computation with porosity to incorporate heterogeneities was presented. Based on the poro-perm relationship from core samples, discrete rock types (DRT) were identified which were further purged to two petrofacies representing clean carbonate facies with presence of vugs and mud dominated micritic facies to facilitate the development of a representative single regression over a porosity range of 5-35 % for the computing ‘m’.

A non-linear regression relationship was established between cementation factor and porosity from the core data representing all porosity ranges and capturing the complete pattern of heterogeneities. Cementation factor estimated using this regression was compared with the available variable ‘m’ from dielectric scanner data and resistivity image logs. The approach used polynomial regression for variable ‘m’ computation which when calibrated against the water bearing layers where the saturation estimated from the four methods viz., using Standard ‘a’, ‘m’, ‘n’ values, Core derived constant ‘m’, ‘n’ values, FMI derived variable ‘m’ and Polynomial regression derived variable ‘m’ was converging to same value. Additional interesting layers in a few wells could be brought out from the study.

**Glimpses of Technical Session**
SPWLA INDIA Chapter Technical Session conducted on 20.10.2023 at Dehradun, INDIA

SPWLA India Chapter conducted a Technical Session on 20th October 2023 at Dehradun. The Technical session was attended by 20+ Petrophysicists. **President** of the chapter Mr. S K Singhal welcomed the gathering and **Vice President (Education)** Mr. Sanjay Vohra gave a short brief on Technical presentation. The Technical Presentation on “**A modern day approach to Electrofacies using MRGC Technique**” was delivered by **Mr. Sumanta Sarkar**, Senior Petrophysicist at Aspentech.

**A modern day approach to Electrofacies using MRGC Technique**

Electrofacies is Sets of log responses that characterize sediment facies and allow it to be distinguished from other sediments or rock types. To put simply Electrofacies are facies, rock types or clusters that are generated or distinguished by differences in log responses.

Geolog’s Facimage interpret log data based on statistical and neural network methods to characterize and predict classes and petrophysical properties. It focuses on Facimage MRGC (Multi Resolution Graph Based Clustering) and KNN (K-Nearest Neighbor) approach.

This method allows a simple, fast, and effective integration of all types of petrophysical and geological information: conventional logs, array and image logs, core measurement, and core description.

There are 4 unsupervised clustering methods available in Facimage:

1. AHC Ascendant Hierarchical Clustering
2. Dyn-Cluster Dynamic Clustering
3. MRGC Multi-Resolution Graph-based Clustering
4. SOM Self Organising Map

Many clustering algorithms require that you specify up front the number of clusters to find. If that number is not apparent from prior knowledge, it should be chosen in some way. The Dynamical clustering and Ascending hierarchical classification methods currently in use, group log values by their proximity (the grouping being interpreter depending).

Unsupervised Classification offers the possibility of exploring the structure of the data without guidance in the form of class information and often reveals features that were not expected or previously known. These classification methods can be statistical or neural network methods. Unsupervised methods avoid the user-bias which supervised methods build in.

A classic approach to facies analysis, automatic clustering, requires an estimate of the number of clusters, with the results being very sensitive to this parameter.

MRGC Proposes the optimal number of clusters, yet allows the geologist to control the level of detail actually needed to define electrofacies. MRGC proposes to the user several optimal number of clusters corresponding to different resolutions. In addition the results of MRGC are organized in a hierarchical way so that the clusters of higher resolutions are always subclusters of the low resolution clusters.

From the decreasing ordered KRI curve several important breaks can be observed, where KRI changes from one stable plateau to another. These breaks correspond to the optimal clusters at different resolutions.
Glimpses of Technical Session
SPWLA INDIA Chapter Technical Session conducted on 04.08.2023 at Mumbai, INDIA

SPWLA INDIA Chapter Organized Technical Session on 4th August 2023, Two Technical Presentations were presented during the proceedings. Brief write-up of the technical presentations and author details are mentioned below:

I. Navigating the Low Carbon Energy Future: The Role of Petro-physicists by Ilius Mondal – Senior Geophysicist(w)
ONGC Mumbai:

The study delves deeply into the pivotal significance of petrophysics in the context of transitioning towards a low-carbon energy future. It meticulously examines the multifaceted role of petrophysics in influencing critical aspects, including carbon capture, renewable energy potential, critical mineral prospecting, and nuclear waste management. By delving into these dimensions, the study elucidates the intricate interplay between petrophysical insights and the pursuit of sustainable and environmentally responsible practices. The research underscores the indispensability of petrophysics as a foundational framework, fostering a comprehensive understanding of subsurface processes and their implications for fostering a greener and more resilient future.

II. State of Art Logging Technologies Provide Comprehensive Reservoir Evaluation Behind Casing in the Absence of Open Hole Data: Case Study from Western Offshore India by Harsh Vardhan – Petrophysicist, Baker Hughes

A case study of careful planning of an optimal and suitable design of the log suite to meet the requirements in absence of any open hole log data was presented. In the absence of any open hole log data, an initiative was taken out to explore technological options for estimating the saturations in a low porosity formation in the cased hole section of well for the required workover. Geochemical logs were recorded for mineralogy and lithology characterization of the formation by elemental analysis for accurate well saturation estimations. A cased hole neutron log was recorded for evaluation of neutron porosity. Four component dipole waveform data was used to generate images of geological structures near the well and calculate acoustic properties of the formation. Multi-detector pulsed neutron logging data provided current formation saturation which helped in re-completing the well in hydrocarbon bearing zones.

Glimpses of Event

Speakers during their Presentation (left) Mr Ilius Mondal and (right) Mr Harsh Vardhan
5th SPWLA India Symposium covers all the realms of Modern Day Industry Challenges

With an action plan to Ideate, Innovate and Integrate, the two-day 5th SPWLA India symposium-2023 on the theme ‘Petrophysics: The E&P gateway from discovery to recovery & beyond’ was formally inaugurated on April 15, 2023 at NBP Green Heights ONGC Mumbai with audio-visual message from Symposium Chief Patron Shri Arun Kumar Singh, the Chairman & CEO ONGC in which he emphasized on the importance of such confluence of industry experts, technology partners, academicians, students and veterans which immensely benefit the E&P industry as a whole. He conveyed that the two-day symposium would provide a platform for forging collaborations, technology partnerships and industry-academia interfaces to further the cause for developing the energy system of tomorrow.

President SPWLA India Chapter Manoj Kumar Tewari ED - Chief Logging Services, ONGC welcomed the industry stalwarts and delegates from fourteen nationalities and exhibitors from various service companies. He emphasized that in today’s epoch of paradigm shift and energy transition, our role is being redefined especially in light of global energy mix for defining the complete subsurface elements in terms of storage, producibility and sustainability of different energy variants. He further emphasized that we are at the center of all subsurface activities across the entire E&P life cycle from discovery, reserves estimation, development strategies, improved recovery, mitigation of well complications, engineering solutions, economic planning to plugging and abandonment. ‘Petrophysics play a critical and crucial role in envisaging and characterizing the complexities and uncertainties of the subsurface formations which is necessary for making informed decisions about drilling, completion, and production strategies. Thus very rightly Logging is referred to as the ‘Eyes’ of the E&P industry. Also with the current advanced Acoustic solutions, it is giving an “Ear” as well,’ he added. He hoped that “Ideate, Innovate and Integrate”- is the mantra that would guide the participants in gearing up for the global energy transition in a meaningful way.

Dr Luis Quintero held the audience spellbound with his interesting presentation
Former President of SPWLA and Global Advisor for Production Management to Halliburton, Dr. Luis Quintero delivered a captivating conference key-note address at the inaugural session on the interesting title "Looking where we can’t see" - How Petrophysics helps meet the world’s energy needs” which spanned the entire landscape from very fundamental baselines to the future energy paradigm. He further said that standard of living is directly proportional to individual energy use. Over the last few decades, the energy consumption and standard of living has seen an uptick. The challenge is to make growing energy demand more and more accessible and affordable. Dr. Quintero stressed that the hard data from logging and petrophysics is central and pivotal to address the growing energy needs. Elaborating on ‘why do we do what we do’ he said that we have to change the way we approach exploration & production of hydrocarbons and attempt to look for what we cannot see. The absorbing keynote address set the tone for two-day technical conference.

Ms. Jennifer Market President-Elect of the Society of Petrophysicists and Well Log Analysts (SPWLA), shared the purpose and goal of the international organisation. She highlighted the various global distinguished speakers with whom the fraternity could interact and understand the latest developments in the industry. She also informed about the various Special Interest Groups (SIGs) of SPWLA which works on finding solutions to the various challenges being faced by the industry. Ms. Jennifer also highlighted the grants/scholarships given by SPWLA to students & educational institutions for research in the field of well logging. Commenting on the role of logging, she said it is not only about hydrocarbons but energy in general.

During the inaugural session, the Lifetime Achievement Award was conferred on Mr. Dinesh Chandra former President SPWLA India and ex-Chief of Logging Services, ONGC for his outstanding contribution to the domain of logging and petrophysics in Indian context.
There were six technical sessions which thematically covered the entire gamut of E&P industry lifecycle through the sub-themes titled Integrating Petrophysics in de-risking Exploration; Maximizing Asset value in Brown fields & mature Basins; Testing, completion and well surveillance; Geo-mechanics in E&P life cycle; Hydrocarbon to low-carbon and no-carbon: attaining financial resilience in new energy paradigm & Value unlock from AI/ML insights and emerging technologies. With common objectives to understand better, quantify more precisely, reduce the risk, explore and expand our horizon, a total of eighteen (18) oral papers and forty (40) digital poster presentations covering studies and works from different genre and disciplines, with different perspectives and novel approaches were delivered by authors from different organizations of the E&P industry. Each session started off with a thought provoking and intriguing Technical presentations by eminent and accomplished Key-note Speakers from across the globe.

All the papers from oral category and digital posters category were evaluated by chairs & Co-chairs involving Industry Veterans, Domain-experts and Special invitees from abroad. All the papers were evaluated on multiple criteria such as presentation skills, content clarity, innovative approach adopted and value addition. Based on evaluations, best and runner-up award was given in each category for the extra effort put in by individuals. The Best Paper in Oral Category was awarded to Ms. Srinivasabharathi VK for her paper on ‘Integrated Analysis of Deep Shear Wave Imaging, High Resolution Resistivity Imaging and Geomechanics for Identification Sub Seismic Features- A Case Study from KG Offshore Basin, India’. Runner-Up in this category was Mr. Phoolchand Mahato for his paper ‘Enhancing the Efficacy of Hydraulic Fracturing Job for Production Improvement of Tight Oil Shaly Sands of Mandhali Formation of Cambay Basin, India through Reservoir Characterization & Integrated Geo-mechanical Studies’. Mr. PT Shaji was awarded with Best Paper in Digital Poster category on topic ‘Critical Factors Affecting the Pulsed Neutron Saturation Monitoring Log Analysis - Lessons Learned from the Case Studies of Brown Fields in Cauvery Basin’ and the Runner-up in Digital Poster Category was Ms. Komal Chauhan for her Paper ‘3D Pore Pressure Estimation of Prospective Locale of KG Area for Future Well Planning’.

Apart from technical sessions, exhibition stalls got an enthusiastic response from different Indian and International companies as well as technical societies from E&P Industry. A total of fourteen exhibition booths were reserved by Baker Hughes, Halliburton, Altus Intervention, Paradigm, NOV, Parveen Industries, SLB, Antares, HLS Asia, Welltec, Kappa Engineering, SPG India and APG India to showcase their competence, technological advancements and activities. The innovative approaches adopted by exhibitors caught a lot of attraction from participating delegates. The exhibition booths were also evaluated by experts on various parameters and ‘Best Exhibitor’ award was conferred on M/s Baker Hughes.

As a prelude to the symposium, under the banner of SPWLA India, Student engagement Programs were conducted for the first time. These programs were conducted at Ahmedabad, Kakinada, Rajahmundry, Nazira and Dehradun with sole sponsorship of Indian national oil company ONGC and support of global service companies. In these programs, the students, future work force of the industry, pursuing their graduation/post-graduation from reputed universities of India were provided industry exposure and kindled their interest about the latest technological developments. More than hundred students from renowned institutes/universities participated in the industry-academia engagement. From among them ten students were shortlisted for complimentary participation in the Symposium.
Prior to main conference, five (5) pre-conference courses were also conducted by global industry experts on advance topics from different facets of petrophysics & well logging viz. Value Addition through Formation Evaluation, Overview of Oilfield Geo-mechanics, Advancements in LWD Technology, Role of AI/ML in Petrophysics and Perforation Techniques to Improve Production. The course contents were designed to cover the subject in depth and were participated by industry practitioners. The courses were well appreciated by the participants.

The two day event was attended by more than five hundred participants in the form of industry stalwarts, distinguished speakers, domain experts, Invitees, delegates from various E&P companies, service companies and exhibitors from India and overseas. The keynote addresses by industry experts Luis Quintero, Jennifer Market, Tarek Abdelfattah, Pavan Srivastava, Rinat Batyrshin, Vinay Malhotra and senior management from Baker Hughes & Halliburton joined the conference across continents and raised the bar of the symposium. SPWLA India hopes that the shared experiences, knowledge, networking, collaboration and new innovative ideas gathered from the two day long technical conclave with intense deliberations would take us to a more efficient and sustainable growth curve. Special mention goes to all the sponsors, exhibitors, authors and participants who played a vital role in making the symposium a grand success.