



“Image better, drill deeper, monetize faster”

- *An interview with Mrs. Sushma Rawat*



Mrs. Sushma Rawat is Director (Exploration), ONGC, and has also become the first lady to occupy the country's top exploration position, within the Energy Maharatna. She is an experienced geologist who brings with her professional industry expertise with diverse perspectives, which is expected to benefit the organization in its exploration endeavours. Beginning as a graduate trainee in ONGC in 1989 as an operations geologist in Cauvery Basin, and subsequent stints at KDMIPE Dehradun as well as Kerala-Konkan Basin in Mumbai, Mrs. Rawat rejoined KDMIPE in 2013. Her dynamic leadership qualities came to the fore here while discharging her responsibility for realizing the Basin scale 3D-Petroleum Systems Modeling for Mumbai Offshore Basin, and KG Basin, which continued for another nine basins to understand the petroleum systems of category I and II sedimentary basins in India. Such significant and outstanding efforts were recognized through the CMD Award in 2015.

Mrs. Rawat continued her quest for more accolades through her exemplary work in subsequent years and gathered her career highlights by way of being the lead member of the ONGC team for identifying and assessing of new areas in category I, II and III basins of the country based on the data available inhouse and the new National Seismic Program (NSP) data. She has been the nodal person for working out the requirement and techno-financial details of parametric wells and planning of NSP lines in all Lesser Explored Basins (category II and III) basins and unprobed areas of category I basins of India, as well as the team lead for an initiative on 'Building Capabilities in Advanced Exploration' as part of ONGC's Long Term Energy Strategy 2040, amongst others.

Apart from all these leadership efforts, Mrs. Rawat has been active in participating and organizing geological field trip workshops on modern deltas in Kakinada, Cretaceous of Trichinapalli, Jurassic of Kutch, Triassic of Spiti, as well as Himalayan Foreland Basin around Mussoorie-Dehradun and the tectonic realm of Karakoram-

Zanskar around Leh. She is also the founding member of various geotechnical societies along with organizing international G & G conferences such as PETROTECH and GEO-India.

When approached for an interview, despite her busy schedule, Mrs. Rawat graciously obliged. The following are excerpts from the interview.

Q. Mrs. Rawat, from being the first women well site (operations) geologist to being the First Lady Director (Exploration) of ONGC, you have been a pioneer at “breaking the glass ceiling”; how do you see your journey in ONGC?

A. I embarked on my professional journey in ONGC as a graduate trainee (GT) in the year 1989, my first posting being as an operations geologist in the Cauvery Basin. Since then, every moment of my 35 years professional journey has been remarkably satiating; filled with new experience and numerous opportunities at every step. Like every GT, I too had a dream of leading this prestigious organization, and I am thrilled to see that dream come to fruition. I express sincere gratitude to all my Gurus, seniors and colleagues for their invaluable teachings, guidance, support, and good wishes which have been instrumental in shaping my professional journey in ONGC.

Being appointed as the First Lady Director (Exploration) itself sends a powerful message about the value of diversity and challenges prevailing stereotypes. It serves as an inspiration for aspiring professionals, encouraging them to pursue careers in sectors traditionally dominated by one gender. ONGC fosters a work culture centered on technical prowess and expertise, regardless of gender. I consider myself privileged to be part of an organization that prioritizes career advancement driven by technical excellence. This ethos not only underscores our commitment to meritocracy but also showcases our inclusive and diverse culture within the organization.



(With the women power of Chennai work center)

With the goal of promoting inclusivity and diversity, my aim is to unlock the full potential of ONGC's exceptional workforce and drive India's progress. From being a dedicated student of geology to leading the exploration efforts of the nation, I believe my personal journey has overcome numerous barriers, and I hope it sets a precedent for generations to come. The Government of India's commitment to embracing

diversity and recognizing talent demonstrates its dedication to fostering an environment of inclusivity. This commitment serves as a beacon of hope, inspiring individuals to pursue their aspirations and transcend societal limitations.

As we progress in our endeavor to explore hydrocarbon reserves in challenging and unconventional terrains, the exploration community seeks effective leadership in data-driven decision optimization throughout the oil and gas value chain. Drawing on the experience gained from various institutes, basins, and assets within ONGC, I am confident in meeting these expectations. By bringing a range of perspectives to the board of directors, I aim to make a substantial contribution to ONGC's exploration strategies and benefit the organization as a whole. This also showcases our diversity and inclusion culture within the organization, highlighting our collective commitment to technical excellence and expertise.

Q. As you have taken over this very important position within ONGC, what are your priority areas demanding immediate attention?

A. The government's vision to ensure the availability of clean, green and equitable energy access to all demands synergized collaboration amongst all the stake holders. ONGC, being the largest NOC, shall play a vital role in ensuring the realization of prognosticated potential of our available hydrocarbon resources. Huge unrealized resource potential of the Indian sedimentary basins remains locked in Category-II and Category-III basins. Therefore, exploration and exploitation of these basins is a key challenge demanding immediate attention. In our endeavor to have a comprehensive exploration strategy in difficult plays, following are the immediate challenges that I foresee:

1. Exploration portfolio optimization: To optimize the exploration portfolio by prioritizing high-potential prospects and efficiently allocating resources. This involves conducting a comprehensive evaluation of existing exploration projects, reassessing risk profiles and making informed decisions on resource allocation to maximize the chances of success and minimize exploration costs.

2. Technological advancements: For ONGC to remain at the forefront of exploration technology tools such as advanced seismic imaging, AI and ML are to be leveraged to enhance the efficiency and effectiveness of exploration efforts.

3. Sustainable practices: Prioritizing environmental stewardship, minimizing the carbon footprint and exploring renewable energy alternatives is also of essence.

4. Talent development and retention: Fostering talent, offering training prospects, and establishing a supportive work environment will play a pivotal role in attracting and retaining top-notch geoscientific and technical professionals. A major emphasis is required for developing the expertise and knowledge base of G&G personnel, providing them with suitable exposure to state-of-the-art exploration tools and methodologies. This focus ensures that the organization maintains a highly skilled workforce capable of driving innovation and excellence in exploration practices.

5. Collaborations and partnerships: Establishing and reinforcing partnerships with national and international stakeholders, research institutions and industry allies are crucial for accessing expertise, knowledge sharing and exploring new prospects. Collaborative endeavors enable the facilitation of innovative solutions, resource leverage, and an enhanced success rate in exploration activities. ONGC is embarking on a strategic outreach program to foster collaborations with international E&P companies,

tapping into their global exposure and expertise, particularly in challenging domains like deep waters. This amalgamation of ONGC's knowledge and experience in Indian sedimentary basins with the technological proficiency and global insights of international companies will yield tangible benefits across the energy value chain and unlock new frontiers in the E&P landscape.

6. *Regulatory and policy environment:* Staying updated on evolving regulations and policies related to exploration activities is crucial. Addressing compliance requirements, managing stakeholders' expectations, and also advocating for a favorable policy environment that supports responsible exploration shall be key for ensuring seamless operations.



(Delivering a keynote address at the National Seminar organized by the Gondwana Geological Society at Nagpur, India)

Q. You mention “technological advancement” and use of technology for revisiting mature fields by extracting more information out of them, which could lead to enhanced production. Are enough efforts being expended in this direction within ONGC?

A. At present, we have a comprehensive strategy consisting of four key components: intensifying exploration endeavors, expeditiously transitioning discovered resources into production, enhancing recovery from existing fields and fostering collaborations with industry experts to reverse the decline in output witnessed over the years. Undoubtedly, technological advancements hold immense potential in bolstering each aspect of this strategy, particularly for mature or aging fields. By harnessing innovative technologies, we can re-evaluate established fields from new vantage points, uncover concealed opportunities and optimize production strategies, thereby revitalizing and maximizing their potential.

Through the utilization of cutting-edge acquisition and imaging methods, such as the node-based seismic data acquisition system, passive seismic tomography, and airborne hydrocarbon sensing survey, we can access intricate subsurface information that was previously beyond reach due to challenging terrains and limited working seasons. These advanced technologies enable us to study large areas quickly and narrow down to potential areas with comprehensive understanding of reservoir properties, and the presence of untapped reserves.

Moreover, the oil and gas industry has witnessed transformative advancements in drilling and completion techniques, including horizontal drilling, hydraulic fracturing and intelligent well systems. By employing these cutting-edge technologies in mature fields, we can unlock previously untapped resources and reinvigorate production. ONGC has also proactively introduced a substantial number of state-of-the-art variable frequency drive (VFD) rigs to drill deep prospects. Additionally, we are diligently pursuing field-specific and modular technologies to expedite the monetization of discoveries.

In recent times, ONGC has also forged strategic partnerships with technology providers, global industry leaders and academic institutions, including Chevron Corporation, ExxonMobil, Equinor ASA, Shell and Greenko ZeroC. These collaborations are aimed at fostering innovation, exchanging knowledge, and jointly developing technologies that accelerates exploration in both scale and speed, reduce costs and minimize environmental impact. The focus of these partnerships revolves around assessing the hydrocarbon potential of selected basins, particularly the eastern and western offshore basins, as well as collaboration in the fields of carbon capture storage and utilization and green technologies like green hydrogen. Moreover, ONGC conducts regular field trials and pilots to assess the effectiveness of new technologies, including enhanced oil recovery techniques, before implementing them on a larger scale.



(Meeting with a delegation of Shell Global at ONGC Delhi office)

ONGC acknowledges the significance of technological progress and has dedicated substantial resources to explore and adopt new technologies. By leveraging these advancements, ONGC is committed to optimizing production and maximizing recovery from its mature fields while leading the way in technological innovation within the oil and gas industry.

Q. For a sustainable reserve-to-production ratio, it is sine qua non that reserves be replenished continually by new hydrocarbons discoveries. This would demand more emphasis on continuing accelerated exploration efforts with efficacy and urgency. What are your plans on this?

A. Ensuring a sustainable reserve-to-production ratio is of paramount importance for the long-term viability of the hydrocarbon industry. It necessitates a focused and efficient approach towards exploration to continually add reserves through new discoveries. Currently, ONGC is undertaking a 3-year accelerated

exploration plan (2022-23 to 2024-25) that encompasses several key objectives. These include expanding operating acreage by two and a half times, increasing the quantum of 3D seismic data acquisition by 2.5 times, and enhancing the exploratory drilling by around 1.2 times. In terms of exploration strategy, we have developed a three-pronged approach based on the exploration status of each basin, thereby optimizing our efforts towards achieving sustainable reserve growth.

- *Re-evaluating mature basins:* This entails a comprehensive reassessment of existing exploration data and geological knowledge. Embracing new exploration concepts and modern technologies is crucial for gaining a deeper understanding of sedimentary deposition and basin evolution to prolong the basin's productive lifespan. By conducting meticulous studies of potential hydrocarbon-rich regions, we can pinpoint areas with significant exploration prospects and concentrate our efforts accordingly. This involves re-exploration and revisiting relinquished areas, considering fresh data and insights in mature basins. The aim is to foster field growth, consolidate existing plays, identify new and emerging plays, delve into deeper/difficult/HP-HT plays, and uncover any missed opportunities.
- *Strategic consolidation in Category-II basins including:* This approach aims to build upon the established leads in the Vindhyan basin, Kutch, Saurashtra, Bengal onland, Mahanadi deepwater, and Andaman ultra-deepwater sectors. The recent exploration success in the Bengal basin and Proterozoic Vindhyan basin stand as evidence of our perseverance and unwavering determination. Prioritizing the monetization of these basins holds utmost importance as it holds the potential to contribute to offsetting the decline in production from mature basins. By leveraging these resources, we aim to bolster production and maximize the potential of these basins.
- *Expanding footprint in category-III basins:* In line with the ES-2040 mandate of broadening the exploration landscape to encompass less explored and unexplored areas/basins, ONGC is actively expanding its footprint in Category-III basins. Through participation in the Open Acreage Licensing Policy (OALP) bidding process, ONGC has already acquired new acreages in basins such as Cuddapah, Narmada, Ganga, Kutch and Saurashtra onshore, as well as South Rewa basins where data acquisition and analysis are underway.

Furthermore, comprehensive plans tailored to each basin have been devised to expedite implementation and achieve desired outcomes within defined timeframes. Accomplishing success in such challenging scenarios, particularly with speed and scale, necessitates the development of capabilities encompassing advanced technology and skill enhancement. To this end, a crucial objective is to establish a robust digital infrastructure that integrates all exploration data, ensuring its future readiness for data analytics and the adoption of AI/ML tools, which are in the early stages of development in the exploration sector. Concurrently, significant emphasis will be placed on enhancing the expertise and knowledge base of G&G personnel, equipping them with exposure to cutting-edge exploration tools and methodologies. Additionally, our R&D centers are undergoing infrastructural upgrades and prioritizing research and development to foster the creation of innovative and forward-thinking solutions for forthcoming exploration and production challenges. Through the implementation of these strategies, we plan to enhance the efficiency and effectiveness of our exploration efforts, thereby maximizing the potential for

new hydrocarbon discoveries and ensuring a sustainable reserve-to-production ratio in the long run there by contributing to ONGC's long-term growth and success with the mantra- *"Image better, drill deeper, monetize faster"*.

Q. Advancement in seismic technology has been a wonderful gift to exploration geoscientists. But this tendency of overreliance on computer software to provide solutions may at times stifle one's analytical and imaginative power that is essential for conceiving novel and innovative geologic plays for exploration. Is this awareness being instilled particularly into the young geoscientists by more hands-on training?

A. The progress in seismic technology has brought about a transformative impact on exploration geoscience, equipping the geoscientists with formidable tools to examine subsurface formations and detect potential hydrocarbon reservoirs. Nevertheless, it is also equally essential to maintain an equilibrium between dependence on computer software and fostering analytical and imaginative capabilities of geoscientists. Recognizing the significance of this equilibrium and the value of hands-on training is particularly crucial for emerging geoscientists. By striking this balance, we can ensure that geoscientists are not only proficient in utilizing advanced software but also empowered to exercise their analytical and imaginative prowess in exploration endeavors.

Through a range of hands-on training programs, workshops, and fieldwork opportunities, we are providing practical experiences that foster critical thinking skills. These initiatives are designed to complement the technical expertise gained through computer software training, enabling individuals to interpret data creatively and think beyond the confines of software-generated solutions.



(Inspecting the aircraft with equipment for AHSS survey in Tripura, India)

Additionally, mentorship programs are playing a pivotal role in fostering the analytical and imaginative capabilities of emerging geoscientists. Seasoned professionals serve as guides, providing valuable support and encouragement, as young geoscientists explore various geological plays and develop innovative approaches to exploration. Through sharing their own experiences and insights, mentors are

inspiring the next generation to think independently, question assumptions, and embrace unconventional ideas. This mentorship dynamic is nurturing a culture of continuous learning and growth, empowering young geoscientists to push boundaries, expand their horizons, and contribute fresh perspectives to the field of exploration.

My primary objective is to position ONGC's exploration activities as a globally competitive entity, setting the benchmark for excellence in the industry. To achieve this, we must prioritize technology upgrades and enhance our capabilities across all aspects of exploration. This involves embracing advanced technologies and enhancing the skills of our G&G personnel, providing them with suitable exposure to cutting-edge exploration tools and methodologies. Additionally, empowering their analytical and imaginative capabilities will be my key focus area.

- Q. Extensive seismic coverage and numerous wells drilled in the basins over the last several decades have provided enormous amounts of geoscientific and engineering data. These massive volumes of multidisciplinary data may be reformatted, reprocessed, and reevaluated by utilizing AI tools such as data mining and machine learning which would help explore new hydrocarbon reserves. Can this be an idea worth initiating under your stewardship?
- A. Undoubtedly, the application of AI tools, including data mining and machine learning, in reevaluating extensive geoscientific and engineering data offers immense potential for exploring untapped hydrocarbon reserves. Effectively harnessing the wealth of multidisciplinary data amassed over decades can provide invaluable insights and reveal hidden opportunities within basins. Recognizing the importance of adaptability in the industry's IR 4.0, I am pleased to announce that we have already embraced AI and ML techniques to streamline time-consuming and repetitive yet essential tasks, such as horizon and fault interpretation. While leveraging technologies from external vendors, we are also developing in-house capabilities to achieve the same objectives.

Under my stewardship, I envision this modest beginning evolving into a comprehensive implementation. We are actively exploring additional avenues for AI implementation, not only in seismic data interpretation but also in seismic data processing, well log interpretation, automatic analysis of cutting samples, etc. This focus on AI utilization will empower us to make significant advancements in our exploration endeavors. Here are a few key aspects of implementing AI tools in this context:

- 1. Data integration:* AI algorithms can effectively analyze and integrate data from various sources, including seismic data, well logs, production data, and geological maps. By consolidating and synthesizing these datasets, we can gain a comprehensive understanding of the subsurface, detect patterns, and identify areas with high potential for new hydrocarbon reserves.
- 2. Data mining and pattern recognition:* AI-powered data mining techniques can efficiently search through massive datasets, identifying subtle patterns and correlations that may have been missed by conventional methods.
- 3. Machine learning and predictive analytics:* Machine learning algorithms can analyze historical data and learn from past exploration successes and failures. This enables the development of predictive models that can help prioritize prospects and guide decision-making processes.

4. *Risk assessment and portfolio management:* AI tools can aid in evaluating the risk and uncertainty associated with exploration activities. By incorporating probabilistic models and scenario analysis, we can assess the potential success of exploration projects, allocate resources effectively, and manage exploration portfolios more efficiently.

Hence, embracing AI tools to explore extensive geoscientific and engineering data holds significant potential. Introducing this initiative would enable us to unlock the full value of our existing data. However, it is vital to emphasize that these tools alone are insufficient without the analytical and imaginative capabilities of geoscientists. Merely adding more data without proper interpretation would be fruitless. Therefore, we must maintain awareness of this balance, particularly among young geoscientists, to ensure their understanding of the complementary roles of AI tools and human expertise in maximizing the benefits of data-driven exploration.



(Delivering her technical presentation at the World Petroleum Congress held at Calgary, Canada in September 2023)

Q. Ma'am, you have had a distinguished career as an accomplished explorationist. What are your most cherished career accomplishments?

A. When I reflect on my career progression, firstly I take immense pride being an ONGCian. In my academic and professional journey, attaining a post-graduate degree in geology and completing the "International Certificate Program in Business Management" course at ASCI, Hyderabad and at the Faculty of Economics, University of Ljubljana (FELU), Slovenia in 2014, through the DPE, demanded unwavering commitment, diligence, and a thirst for knowledge. Sharing knowledge with others is an instinct I value, evident through my publications in national and international forums, including technical presentations delivered in EAGE and SEG platforms abroad. Additionally, I have actively contributed as a founding member of various geotechnical societies and organized esteemed International G&G conferences like PETROTECH, SPG and GEO-India.

Additionally, I take immense pride in the practical applications of my work. Engaging in field surveys, analyzing geological data, and contributing to environmental assessments have provided me with invaluable opportunities to apply my knowledge in real-world contexts. I have actively participated in and

organized several geological field workshops, including those focused on modern deltas in Kakinada, the Cretaceous of Trichinapalli, the Jurassic of Kutch, Triassic of Spiti, as well as the Himalayan Foreland Basin around Mussoorie-Dehradun and the tectonic realm of Karakoram-Zaskar around Leh.

I got the opportunities to lead several teams, successfully executing complex projects, publish influential research papers and implement sustainable practices. These collective achievements highlight the transformative power of collaboration and the significance of teamwork in attaining meaningful outcomes. As a vital participant in the Government of India's initiative to appraise previously unexplored basins and expand exploration efforts, I also had the privilege of leading the MDT team for the resource reassessment of the Mumbai Offshore Basin under the "Re-assessment of hydrocarbon resources for sedimentary basins and deepwater areas of India" initiative.

Furthermore, I held the position of lead member within ONGC's team, responsible for identifying and assessing new areas in Category I, II, and III basins across the country, utilizing both inhouse data and new National Seismic Program (NSP) data. Serving as the nodal person, I worked on determining the technical and financial requirements of parametric wells and the planning of NSP lines in lesser explored basins (Category II and III) and unexplored regions of Category I basins in India. As part of ONGC's Long-Term Energy Strategy 2040, I led the initiative on "Building capabilities in advanced exploration." Notably, my work on "Planning, monitoring, evaluation and benchmarking of R&D projects in an integrated national oil company" presented at ASCI Hyderabad, and "Process and parameters - driver for furtherance of exploration investment" presented at the FIPI R&D Conclave-2019 received high acclaim from the E&P community.

Lastly, my appointment as Basin Manager of A&AA Basin was a great learning opportunity for me in both technical as well as administrative domains. My endeavors were focused on embracing newer technologies to address longstanding challenges. Noteworthy advancements include, as I said earlier, the adoption of node-based seismic data acquisition, passive seismic tomography, and airborne hydrocarbon sensing survey. I relentlessly worked towards resolving various long-standing issues such as exploration in DAB areas, streamlining forest clearance and LAQ processes and expanding exploration into newer areas such as Nagaland, Manipur, and Meghalaya states. To bring the academic rigor into exploration and to recognize the importance of industry-academia synergy, I led initiatives resulting in the signing of MOUs with North East Hill University (NEHU), Shillong, and CSIR-NEIST, Jorhat, facilitating collaborative projects under strategic alliances.

Besides all this, being a board member of ONGC Tripura Power Company Limited (OTPC) and ONGC Petro Additions Ltd. (OPaL) gave me valuable insights into downstream energy business, corporate governance, and overall energy scenario of the nation. All these experiences and my work in a wide spectrum of exploration domain probably helped me in my selection as Director (Exploration) at ONGC. This is not only a significant career milestone due to the position itself, but also because of the immense responsibility it entails. The charge of fulfilling the energy security of 1.4 billion Indians rests upon our shoulders, and it can only be achieved through accelerated exploration and continuous reserve additions. While the challenge is substantial, I firmly believe that challenges provide the opportunity to bring out one's best. They also inspire me to set new goals, confront new challenges, and persist in my pursuit of excellence not only as a geologist but also as an energy warrior.



(With the ONGC delegation at the World Petroleum Congress held at Calgary, Canada in September 2023)

Q. Lastly, Madam, what is your expectation from the upcoming 14th Biennial International Conference and Exposition, 'SPG 2023'.

A. Being the Patron of SPG, I am delighted to share that the Society of Petroleum Geophysicists (SPG) is providing us with a platform through the 14th Biennial International Conference and Exposition in Kochi. The core focus of the conference lies in its robust technical program, which comprises several pre-conference *continuing education* courses and a field trip, conducted by national and international domain experts. Apart from the technical program, the exposition serves as a pivotal platform for national and international exploration and production companies and vendors to showcase their cutting-edge technologies, capabilities, products, and services. This exhibition not only facilitates knowledge exchange but also fosters business collaborations and networking opportunities.

The students' program has always been an integral part and amid the highlight events of SPG conferences. As has been done traditionally, the forthcoming conference will also feature many interactive and informative students' activities. SPG will be inviting students and faculty members from SPG student chapters and premier institutes across the country.

SPG 2023 is eagerly anticipated to be honoured by the esteemed presence of numerous internationally renowned experts hailing from diverse spheres encompassing both Industry and Academia. Overall, SPG 2023 promises to be an extraordinary amalgamation of technical excellence, business acumen, and academic engagement, creating an inspiring and enriching experience for all participants. 