The Geological Society of India, Bengaluru, conducted the National Seminar on ‘Gold Mining in India: The Way Forward’ on the 15th and 16th of February, 2019, in collaboration with Mining Engineering Department, Dr. Thimmaiah Institute of Technology, KGF, and the Mining Engineers’ Association of India, Hyderabad. The Organizers were prompted to hold such a seminar considering decades of stagnation of gold mine production and lack of any progress in development of new gold mines in the country. The Seminar is in keeping with the Theme of the first Seminar on Gold Mining Industry in India organized by the Society in year 1960 (Mem.1 of the Society). The Seminar provided a common platform to exploration geologists dealing mainly with gold, mining engineers and academicians involved in research on different aspects of gold genesis, mobility and ore formation processes, to exchange their views. It was also aimed at administrators at the State and Central level dealing with implementation of mining laws, to share their experiences and thoughts through meaningful debates so as to provide a much needed fillip to gold exploration and mining in the country. One may note that in attempting to satisfy the huge demand of over 800 tonnes in the country, India, being a net importer of gold expends about US$ 35 billion each year ranking next only to the cost of oil imports! Though upwards of 800 tonnes of gold were recovered from the World-class mines at the Kolar Gold Fields until their closure in 2001, presently the only producing gold mines in India are located at Hutti in Karnataka that produce about two tonnes of gold annually. It may be mentioned here that the last major seminar on gold exploration related topics and field workshop was conducted way back in 2009 by the Geological Society of India. The seminar was also aimed to provide a platform for discussion on making the now abandoned Kolar Gold Fields a Geo-tourism hub as enunciated in the global Geopark theme, so that there is scientific preservation of material, buildings and mine structures at KGF that has a history of over 150 years, and for dissemination of knowledge of mining practices to students and itinerant tourists. Such acts would help boost the economy of the township that depended on its mining activity in the past and is presently on an economic decline.

Inauguration:

The two-day Seminar started at the spacious, well-equipped auditorium in the sylvan surroundings of the Dr. Thimmaiah Institute of Technology in the forenoon of 15th February, 2019, with a welcome address by Shri R.H. Sawkar, Secretary, Geological Society of India. He recounted in brief the role of the Geological Society India, which was established in 1958 in promoting activities in myriad aspects of Earth Science studies and developments in the country, including holding of National Seminars and workshops on the topic of Gold in 1960, 1996 and 2009. These Seminars, he pointed out, apart from achieving fruitful technical discussions involving experts in the field also raised awareness on problems faced by the exploration and mining industry among planners and administrators at both the State and the Central levels. Shri Sawkar touched up on the history of the KGF mines and opined that opening up satellite mines around KGF and winning gold from the tailing dumps would revive economies.
of the mining town. He pleaded for formation of Gold Authority in this context. He fondly recalled his erstwhile association with Dr. Thimmaiah at the Mysore Minerals Limited and made a mention of the latter’s concern for education and philanthropy. The raison d’être in holding the present Seminar and the themes to be discussed were explained succinctly by Dr. Vasudev, Convener of the Seminar. He stressed upon the need for utilizing the considerable gold resources lying idle in different parts of India for lack of sustained exploration and mining activities due to constrictive MMRD act provisions and want of tax incentives. He called for liberalization of rules governing the above issues and stated that the recommendations of experts participating in this Seminar would be pointedly conveyed to concerned authorities for taking remedial actions. Dr. Syed Arif, Principal of the Dr. Thimmaiah Institute spoke on the pioneering role of Dr. Thimmaiah in starting this educational hub in Kolar Gold Fields to provide the much needed fillip for higher education. He also informed the audience on the munificent scholarship schemes established by the Institute through the concerns of the present President of the Institute that has gone a long way in providing technical education to the needy. He stated that the Institute is ranked 9th among 217 such colleges under the VTU. The Chief Guest of the function, Dr. B.K. Sahu, DDG, RSAS, GSI, Bengaluru appreciated the holding of a Seminar on Gold exploration at this juncture. He informed the audience that GSI has recently been employing private agencies in an endeavor to search for hidden mineral deposits including gold in different parts of the country. The Guest of honour, Shri Charles Devenish of Geomysore Services Ltd., a pioneer in mineral exploration, and who started a very successful exploration in India at Bengaluru in collaboration with Dr. Vasudev, honed in on the critical state of exploration activities in India. He pointed out that despite boasting large resource position in many commodities exploration and exploitation in the country have lagged behind many other countries. He stressed for adopting the modus-operandi of Canadian and Australian Governments in liberalizing rules and regulations for active participation of Private Entrepreneurs in exploration and exploitation fields with Governmental agencies playing a minimal role. The President of the function, Dr. Venkat Vardhan, also President of the Dr. Thimmaiah Institute, stated that from what he could gather from a discussion with experts on the Gold Exploration scenario...
what the Gold Exploration industry needed was to follow the lead of the success story of the Cinematic Industry in the country by lobbying with Government at various levels for industry status. He pointed out that once the Industry status was accorded by the Government to the Cinematic field of activity there was an astronomical financial upswing with large revenues being generated and employment generated.

**Technical Sessions:**

The two-day technical sessions saw Oral Presentations of 46 papers out of the 59 that were slated to be presented by Geoscientists from different organizations, spread over VII technical sessions, including parallelly held sessions V and VI. Apart from these Poster Presentations included 6 displays exhibiting works that could not be accommodated in Oral Presentations.

The Technical Session I was chaired by Dr. R. Srinivasan and Mr. C.V.Seshadri. Four of five papers listed include the Key Note address by Shri Biswas, formerly of the Geological Survey of India, who gave a synoptic account of gold prospects in different parts of India. He lamented on the lack of or no progress being made for exploitation of the prospects painstakingly and methodically discovered through sustained efforts of exploration geologists of the Geological Survey of India over the past many decades. In another hard-hitting and critical Key Note address on the prospecting and mining issues faced by the gold industry, Dr. Vasudev, an eminent exploration geologist of the country, presented statistics on different aspects of the Gold Industry in the country and the positive role played by private investors in the exploration scenario. He advocated the cause for mining in gold prospects on different scales and for speeding up of activities in this field. He specifically mentioned the success through dogged perseverance in obtaining mining leases for the Jonnagiri and Ganajur prospects in Andhra Pradesh and Karnataka respectively through companies that he was associated with. He traced the history of discovery of gold prospects in India, the resource and reserve scenario, the inadequacies of the MMRD act and hurdles, the positive role of the Niti Ayog and summed up pleading for commissioning of a Gold Authority as a panacea. Dr. Sangurmath, Executive Director (I/c), Hutti Gold Mines Ltd., delivered a homily on the need for accelerating the exploration activities for
Technical Session II on Geology, which was chaired by Prof. Biswajit Mishra and Dr. H.M. Ramachandra, saw presentation of 9 papers heralded by Dr. Mohakul of the Geological Survey of India, who presented a comprehensive and graphical account of the more than a dozen important gold prospects located in the Chitradurga Schist Belt. He also ably described the differences in spatial, temporal and genetic variances in these gold prospects and attested to the future mining potential of these small deposits. Dr. Sandip Roy, also of Geological Survey of India, gave an erudite account of deformation event-ore mineralization aspects of the Hutti gold mines. He specifically demonstrated the discrete nature of deformation events in the area and documented the nature and evolution of the ductile shear zone in the gold mines and its relation with the ore formation process. Dr. Pranjit Hazarika of Guwahati University presented a case for correlating the metamorphic grade and structural level of exhumation of different Archaean greenstone belts in India with the abundance of gold contained in such belts for arriving at better exploration strategies. Dr. Sakti Saravanan of IIT Bombay, in a formal treatment discussed the nature of the granodiorite in the Jonnagiri gold prospect and the relationship of the granite evolution with ore formation in the belt. A description of the Kunderkocha gold prospect in Singhbum Craton was given by Dr. M.K. Ojha, Assistant Professor, NIT, Durgapur. Dr. Pradeep Kumar of the Geological Survey of India presented field, petrographic, geochemical and sulphur isotopic characters of the Paramannahalli gold prospect that forms a part of the Chitradurga belt. The lecture by Shri Kotnois of the Dr. Thimmaiah Institute of Technology prompted inputs from experienced exploration experts to show that the southern tail of the Kolar gold belt was indeed quite long. The occurrence of gold as lattice-inclusions within pyrite was highlighted by K. C. Nimmy of the Geological Survey of India who inferred that remobilization of this gold would require a strong degree of deformation. Dr. Amit Tripathi, of MPXG exploration Pvt Ltd., Hyderabad, dealt with integration of geological and geophysical datasets in enabling innovative interpretations targeting mineral commodities through software developed by his company.

In the Technical Session III on Exploration & Resources, which was chaired by Dr. B.K. Sahu, Dy DG, RSAS, GSI, Bengaluru and Dr. Hanuma Prasad of GeoMysore Services, 5 papers were presented and discussed. Dr. P. Sangurmath, speaking on developments in the Hutti gold mine, informed the audience that a new decline and circular shaft are being commissioned at this mine. This would, he stated, nearly double the output of ore won from the mine and hence boost productivity. He gave further examples of relevant modern mining technology employed at the mines cluster. Dr. Devarajan of Geomysore Ltd., gave an excellent account of creative and innovative exploration practices employed in proving the reserves of gold deposit at the Jonnagiri prospect where his company is hopeful of starting mining for gold in the near future. He highlighted the unique granite-hosted nature of the ore body and the control exercised by the ductile shear and related lineation that have constrained the gold lodes in the prospect.
Dr. Guha, formerly of the Geological Survey of India presented details of the Bhukia gold prospect from Rajasthan, the only major gold prospect yet reported from that area. He described the basemetal mineralization that is associated with gold and the metamorphic conditions of ore formation. This prospect represents one of the most important in the country that could shortly be mined. Dr. Peshwa of the Deccan Exploration Services Private Ltd., dealt with details of the Ganajur gold prospect that may shortly be opened up for mining by M/s. Deccan Gold Mining Company Ltd. He showed that this prospect in the Dharwar Craton is one among the cluster of rich prospects in the area and held out promises of many such prospects holding potential for mining in near future. The great potential for gold mining in the Gadag area in the Dharwar Craton was attested to by both historical and recent data presented by Dr. Ashok Rao representing the Ramgarh Mining and Minerals Ltd. Dr. Rao was able to show the economic reserves that await mining in several parts of the Gadag belt and highlighted the environmental constraints and hurdles inhibiting mine development in the area.

Technical Session IV on Emerging Trends in Exploration, Mining & Processing, which was chaired by Mr. S.C.R.Peshwa & R. Madusudhanan began on the second day, 16th February, 2019, with a series of Key Note addresses wherein a total of 6 papers were presented. In his timely and crisp Key Note address on the much needed reporting standards in exploration for gold and other commodities Dr. Devarajan pin-pointed the lack of quality in the existing scenario. He exhorted exploration professionals to adopt benchmarks and proper quality control in gold exploration to obtain reliable and reproducible results. In another Key Note address, Dr. A.K. Sen of HCL drew upon his vast experience in different mines to speak about developments and innovations adopted on mining practices in India. In particular he stressed on the developments borne due to necessity in different mines and narrated a host of case histories in which he was involved in the past several decades of active mining. Dr. Vidhatri of the HGML delivered a Key Note address dealing with the metallurgical process adopted in the HGML for extraction of gold from the ore and intricacies of techniques. This was followed by a high-decibel lecture by the eminent Geostatistician Dr. Sarma, formerly of NGRI, who made out a strong case for employing proven Geostatistical principles in fine-tuning exploration and resolving mining bottlenecks bolstered with case histories from producing mines and prospects in the country. Dr. G.Karunakar of the Vedanta Ltd, presented a summarized account of the geology and nature of gold prospects of the Baghmara area of the Sonakhan belt in Central India and highlighted its mining potential. Dr. Sahendra Singh of ISM, Dhanbad, in his lecture raised the important issue of difficulties involved in detection and estimation of gold ores and pointed out that Nanogeoscience could go a long way in solving many such related issues.

Technical Sessions V and VI were held parallelly. Technical Session V, which was chaired by Dr. G.Karunakar of HZL and Dr. Amit Tripathi, saw a marathon presentation of 12 papers and was quite lively with young geoscientists presenting their work in large numbers. The session began with a summary of work of MECL on gold prospects in different parts of India being ably accounted for by Shri Narayana Moorthy. He in particular mentioned the positive potential of the Ajjanahalli prospect in the Chitradurga Belt and Parasia prospect in Singhbhum, both of which he opined could be opened up as mines. He also stated that the Chimmalgund prospect in Karnataka had abundant potential for being mined if other connected issues are resolved. Shri M. A. Khan formerly of Geological Survey of India delivered a detailed talk on gold mineralization in the Mahakoshal belt in the Central Indian Tectonic Zone that hosts more than 30 important prospects. In particular he mentioned the high potential of the Gurhar Pahar and Gulalidih prospects and suggested that such prospects should be taken up for consideration of mining in near future. Shri Vivek of MECL spoke on the gold reserves in the Chigargunta deposit of the Kolar belt that NMDC is proposing to reopen. He gave a detailed account of the paying lode systems at these abandoned mines and tabulated the reserves estimated through their exploration work. He made out a strong case for mining to be taken up at the site. In a refreshing report of exploration work carried out in the Kunigal belt, Ms. Swapnita Brahma of the Geological Survey of India described the gold potential of the belt. She described presence of discrete shear zones in the belt and the role of granite magmatism related to gold potential. Dr. Dora also of Geological Survey of India presented a lively, comprehensive and professional account of the Dubarpet basemetal-gold prospect in western Bastar Craton. He
summarized data accrued from different methods of study, instruments and sources and ably compiled them so that logical interpretation on potential of the anomaly, genetic aspects and controls of deposition could be achieved. Another professional delivery of the account of the gold prospect in the Babaikundi Shear Zone of Singhbhum was given by Dr. Sesha Sai of Geological Survey of India wherein he showed the segmented nature of the rich lode system and its proximity to the Tamar and Parasia prospects in Singhbhum. Dr. Shivani Hulaji presented detailed results of zircon geochemistry from Hungund belt in Dharwars that may help in gold exploration. Dr. Debasis Pal discussed the alteration assemblages in two types of host rocks in the Chigargunta prospect of the Kolar belt and showed that the differing bulk compositions control the alteration assemblages derived and affect gold mineralization. Dr. Srinivas and Dr. Gedam, Geophysicists of Geological Survey of India presented methodical geophysical surveys carried out respectively in the Ramgiri-Penakcharla belt in Dharwars and Betul belt in Central India in exploring for gold and other metal prospects. In a peppy talk, Shri Sitaram Kalluri of the Siva Analytical labs stressed on the need for proper sampling strategy and careful planning of the analytical method in achieving proper analytical results and mentioned the strict benchmarks employed at his laboratories in carrying out such analyses. In a departure to the above trend of papers, Shri Chandra Shekar Math formerly of the MGD, Karnataka, presenting a refreshing method of gold extraction involving lichens and microbes that could be industrialized.

Technical Session VI, chaired by Mr. A.K.Sen of HCL and Mr. T.Victor, Past President, MEAI, mainly dealt with mining methods and innovations and was aimed at providing a platform for young mining students/Researchers and professionals, but sadly only 5 of the listed 11 papers presented. Among these was a narration of history of mining at the KGF ably done by Shri Selvan, OSD, BGML. Mr. Kotnise of the Dr. Thimmaiah Institute of Technology presented a case history of effect of blasting from a quarry in Kerala on behalf of Dr.Syed Ariff. Shri Ravi Chandran Raj of the Arrows Mining Technologies Ltd., made out a case of ammonium nitrate replacing dynamite as the blasting medium and its advantages in modern mining. U. Viswanath of Carl Zeiss Microscopy made out a strong case for use of automated microscopic techniques in exploration practices. Shri Vivek Ranganathan from the Tanka Engineers LLP presented a detailed account of the case history from the Jonnagiri gold prospect for devising an extraction method for winning gold from the ore, with formulation of a flow-sheet for the most effective industrial extraction process.

The Session VII, Chaired by Mr. R.N.Selvan, OSG, BGML and Mr. N.Rajendran, mainly dealt with the theme of Geopark/Geotourism specifically included by the organizers to rouse the interest among planners, researchers, government agencies and tour operators to make KGF an educational hub for mining technology, past and present, and a tourism destination loosely based on the Geopark concept. Dr. Ramachandra, formerly of the Geological Survey of India, introduced the audience to the concept of the Global Geopark especially the link between Nature, cultural heritage, traditions and economy of a region, in this case the KGF. He also described the not-so-good state of maintenance of the National Geological Monuments maintained in different parts of the country including the two located in
the vicinity of KGF. Dr. Vasudev, cueing in from the above, described in detail the preservation of ancient and modern mining methods, local traditions and tourism attractions offered by abandoned mines in South Africa and Australia, followed by Dr. Ventakaswamy, formerly of GSI, who discussed at length the natural endowments and mining legacy of KGF and how it can be profitably converted to an educational and tourism hub. In continuation of the above theme, Varshnavi and her team from the Dr. Thimmaiah Institute detailed the Architectural heritage of old colonial buildings at KGF. Divya and her team from the same institute sounded a note of caution on anticipated ecological impacts of treating the tailing dumps of old mining activity in KGF. Rajah Vijay Kumar of the Science Energy Research Institute presented two interesting papers dealing respectively with extraction of gold from tailing dumps at KGF using microbial nuggetization processes and winning gold and other metals from the impounded mine waters in KGF mines and making such waters potable through use of FPSB technology. The technologies discussed presented a very rosy picture of the economy of operation as well and provided much food for thought.

Concluding Session:

The concluding session of the smoothly and successfully conducted Seminar was held in the evening of 16th February, 2019 at the main auditorium of the Dr. Thimmaiah Institute of Technology. Dr. Ramesh, HOD, Mining Engineering Department of the Institute welcomed the dignitaries gracing the concluding session and the delegates. He provided a crisp, short biodata of the dignitaries present. This was followed by a summary of proceedings of technical part of the Seminar by Dr. H.M. Ramachandra, a Co-Convener. He gave a brief account of the salient feature of each paper presented at the Seminar followed by presentation of salient recommendations of the seminar by Dr. V.N. Vasudev. Mr. D.V. Pichamuthu, Guest of honour, in his address stressed the need for making valid recommendations to impress upon the authorities the need to address the grievances of the industry and that the seminar should not just a way forward to the next seminar. Mr. R.N. Selvan, OSD, BGML congratulated the organisers for successfully organizing well attended seminar in KGF and assured the support of BGML in Society’s effort in making KGF as Geotourism/Geopark hub. The Chief Guest, Dr. I.D. Ashiya, DDG, SU: Karnataka and Goa, GSI, Bengaluru, speaking in chaste Hindi, lauded the quality of technical presentations that he was witness to, and mentioned that in the present year a large number of new investigations have been taken up by the GSI both in Karnataka and on All-India basis. He also stated that his office would push for auction of selected blocks at the Ajjanahalli gold prospect in the Chitradurga belt. Shri Sawkar, who presided over the function, complemented on the smooth conduct of the Seminar and congratulated all the participants. A short but significant
felicitation program followed for honouring Shri. M.H.R. Rao. He was associated with the BGML starting his carrier as a mining probationer till his retirement as Director (Technical) and with the mining industry for many decades. At the outset, Dr. Sen, Mining Engineer, Hindusthan Copper Limited, read out the impressive citation of Shri. Rao, highlighting his monumental contributions to the Mining Industry, especially at BGML involving introduction of innovative technical practices and in man-management in running a highly profitable cluster of mines. Shri Victor, a long-time associate of Shri Rao and past president of MEAI recalled personal anecdotes in his emotional address. Shri C.V. Seshadri spoke in a similar vein and brought out the stern administrative nature and humanistic aspects in the personality of Shri Rao. On his being thus honoured, the nonagenarian Shri. Rao spoke at length in loud and clear voice with utmost clarity belying his advanced age, his experiences in running one of the oldest and most profitable gold mines in the world. His comments on the mining aspects and the gold industry in general sounded relevant in the present day as well. Dr.M.Venkataswamy, the Organizing Secretary of the Seminar thanked all the dignitaries, technical contributors, the Dr. Thimmaiah Institute and the many sponsors who supported the venture with their liberal contributions without which the conduct of the Seminar would not be a reality. He thanked all the staff of the Geological Society and of the Dr. Thimmaiah Institute for their commendable cooperation in conduct of the Seminar.

The seminar was followed by a day-long field excursion on 17th February 2019 across the schist belt starting from the western margin to expose the delegates to the geological set up and mineralization characteristics. The excursion was attended by over 100 delegates including students. The participants could also visit Henry shaft and associated cooling plant in Nandidurg mine as a part of the excursion, courtesy BGML

**Recommendations:**

At the end of the Seminar, a committee of experts involving exploration and mining professionals and those academically inclined arrived at the following recommendations. These would greatly help removing administrative and legal hurdles presently hampering development in exploration and mining sectors.

a. The current resource base of gold is about 650 tonnes and there is abundant scope for establishing new gold mines and revival of once operating mines.
b. The existing Acts and Rules have not been able to attract private investment into exploration and prospecting. Therefore, it is imperative to amend the MMDR Act-2015 to conform to global best practices by doing away with the extant auction mode of granting license for Gold Prospecting.

c. Adequate incentives such as Tax Holidays be built into the Act to enable marginal grade gold resources mineable and development of a large number of small scale gold mines (<10 tonnes of gold Reserve).

d. The Indian geological conditions being similar to gold rich countries, high levels of investments are needed to trigger intensive exploration that could make India countable among the significant gold producing countries in the world and reduce the prevailing high Trade deficit.

e. KGF being known for its gold mining antiquity and 125 years of modern mining heritage with many technological firsts could be transformed into a magnificent tourism and educational hub on the lines of Gold Reef City Tourist hub of Johannesburg in South Africa, and Ballarat and Kalgoorlie in Australia.

f. About 35 million tonnes of tailing dumps containing extractable gold at KGF are a great asset valued at about 5000 crores. Bacteria or microbe mediated technology is now available in India to extract gold from the tailings. The ministry of Mines should encourage utilization of these technologies for extraction of gold and pumping the processed tailings back into old mines to fill the voids. Such a move will create real estate space near the existing township.

g. There were suggestions for utilization of vast quantities of water in the old mines.