

Report on 'The Deccan - Next', International Conference, Savitribai Phule Pune University (SPPU), Pune, Maharashtra, India, 1 - 5 October, 2023

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An International Conference 'Deccan Next' with 3 days of paper presentation and poster display followed by a two-day field excursion was held at the SPPU, Department of Geology, to update and review the developments in the studies on the Deccan Volcanic Province (DVP) in the New Millenia and plan for future studies. The conference started with a 2-day pre-conference workshop for the young researchers and students where the eminent and practicing workers from DVP delivered useful lectures. The main conference further had nine (9) themes with thirty-seven (37) presentations including ten (10) invited lectures from leading current workers. It had also a major poster section with fifty-seven (57) displays, largely by the young researchers from different Indian universities and research institutions. A major highlight of the conference was the honouring of five (5) senior workers who have made significant contributions on the DVP.

The conference started with lighting of lamp by the dignitaries followed by a prayer. Prof. Suresh Gosavi, Honourable Vice Chancellor of the SPPU presided over the function and inaugurated the conference by addressing the august gathering. Prof. Gosavi in his address complimented the organisers. Dr. Ashish Dongre, formally welcomed the guests and the participants both from India and abroad. Dr. Sangode, Head of the Department of Geology, SPPU, outlined the pioneering studies and efforts by distinguished predecessors from the Department on the DVP. He also briefly outlined the objective of the conference and hoped that this endeavour of 'Deccan Next' will usher in new

approaches in the study of the DVP.

The Chief guest, Dr. Shilesh Naik, Director, NIAS, Bengaluru, in his address complimented the organisers for the timely planning of such long awaited gathering and urged for new studies and approaches to understand the issues related to DVP. He emphasized that there is need to take up research programmes that are more relevant to the current challenges with profound societal bearings and impact such as climate change related heavy precipitations that lead to land subsidence, landslides in the Western Ghats and other places. Such events also impact the shallow groundwater regimes that have an influence in slope stability, leading to landslides. He briefly dwelt upon the intra-plate earthquakes, such as Koyna and Khilari within the western DVP since the late 1960s, that opened new challenges both in the urban and rural areas of Western India. He cited the major scientific drilling programme at Koyna and Khilari, aided by MoES and also with inter-departmental cooperation (NGRI-AMD at Khilari) has led to the Borehole Geophysics Research Laboratory (BGRL) at Karad by MoES with core drilling planned up to 8 km so as to understand the Deccan basalt pile, about a km thick and the basement gneisses in terms of their strength and stability to endure strain. He referred the inference from current studies that the rocks shear around with an earthquake intensity of c. 5.2 R, somewhat alleviating fears of a larger intensity earthquakes and planning structures accordingly. He advised that future research proposals need



Fig.1. Lighting of the lamp during inauguration and dignitaries at the Dias (a; from the left). Dr. Mohabey, Dr. Sukanta Roy, Dr. Sangode, Dr. Gosavi, VC, SPPU, Dr. Shailesh Nayak, Dr. Vivek Kale and Prof. N.V. Chalapathi Rao. Welcome address by Dr. Ashish Dongre. (b) Release of the Abstract volume.



Fig. 2. Group photo of the participants, Deccan Next, October, 1-3, 2023 at the Department of Geology, SPPU, Pune.

to be addressing societal-challenges, besides academic approaches, so as to be considered favourably by the funding agencies. This was followed by refreshments where the guests and workers jubilantly greeted each other before starting the sessions.

The Session 1, on 'Deccan Volcanism: Physical volcanology, felsic and mafic magmatism' was chaired by Dr. Shailesh Nayak. Dr. Vivek Kale delivered invited talk on 'Deccan Volcanism and Stratigraphy: Perspective from the Known to the Unknown'. He gave an overview of current status of the stratigraphy, both Chemo by the IIT-US-UK groups and the geologically mapped, physical attributes, by the Geological Survey of India (GSI). He highlighted the challenges in reconciling with long distance correlations between the different sub-provinces (Western Ghats, Malwa, Saurashtra and Mandla), with or without major faults, besides multiple eruptive centres, the nature of the basement, faulted or otherwise, consisting of the Precambrian, Jurassic and Cretaceous rocks and their relief. Prof. Hetu Sheth, in his invited talk on 'From flood basalts to flood rhyolites and more: volcanological puzzles for the Deccan -next' dealt with the challenges of morphological changes in flows as they propagate over long distances and their morphological changes from one form to the other (e.g., pahoe hoe to rubbly or 'aa' types) due to changes in temperature as they cool, compounded further by topography. He further dealt on the major rhyolite or ignimbrite sheet-flows from Saurashtra, brought to light in great detail by his group at IIT, Mumbai in the last two decades. The other papers presented in this Session include those of Anne Jay (Towards Consilience in Deccan Research), S.F.R. Khadri (Flow stratigraphic correlation of Western Deccan basalt province with Malwa, Mandla and others), Janisar Shaik (Physical volcanology of Pawargarh rhyolites) and Anmol Naik (Extremely high-grade, lava-like rhyolitic ignimbrites at Osham Hill, Saurashtra).

Session 2 and 3, continued on the same theme as Session 1, was chaired by Prof. Hetu Sheth and Dr. Anne Jay, had five presentations. Priya Dutta provided an overview on the 'Extension of Deccan flood basalts in the Western continental margin of India'. Purnima Konwar presented her preliminary observations on the dykes from western Maharashtra based on multi-thematic approach. Paramita Paul presented an account of the subaqueous lava flows around Chindwara,

MP. Arunoday Shekar spoke on the 'Danian-age, explosive Dongri ignimbrite sequence from Mumbai'. Pim Kaskes and others presented an account on the 'Application of portable XRF and its efficacy in distinguishing different Deccan basalt formations' with examples from the Bushe Formation which shows distinctly lower Ti abundances than the Poladpur, Ambenali and Mahabaleshwar formations, and broadly confirmed previous studies.

In his invited talk on 'Progress and uncertainties in U-Pb geochronology of the Deccan Traps', Blair Schoene, presented the challenges, in spite of its accuracy, in obtaining zircon to precisely date the effusive events. Payel Dey spoke on the giant plagioclase basalts (GPBs) from the Mandla lobe and its possible utility in correlating with the Western Ghat lava sequence where GPBs are an established marker horizons in the flow sequence. Meena Gupta, spoke on the characters of basalt flows from a borehole from Jalal Kheda, Nagpur district. Bidisha Bayan spoke on the importance of paleomagnetic, geochronology and geochemistry studies on dykes from the Dharwar and Deccan province.

This session was followed by the 'Felicitation Ceremony' wherein five distinguished workers were felicitated for their immense contribution to the study and understanding of the DVP for over five decades. Dr. Vivek Kale recalled the contributions of Prof. Peshwa, especially in recognising for the first time the giant plagioclase basalts (GPBs) in the Western Ghat sequence and related petrological studies. Dr. Peshwa thanked the organisers for their gesture. Dr. Kale received the citation on his behalf from Dr. Shailesh Nayak, who presided over the function. This was followed by felicitation to Prof. S.F. Sethna, who had carried out the detailed studies on Phenai Mata, a major plutonic gabbro-anorthosite complex from the Narmada region besides extensive studies on the Bombay area on dykes, other rock types and the studies on clinopyroxenes from the Deccan basalts and dykes. Prof. Hetu, received the citation on behalf of Prof. Sethna. Prof. K.V. Subbarao was felicitated for his immense contributions in the field of stratigraphy, petrology and palaeomagnetism. Prof. S.F. R. Khadri, narrated the contributions of Prof. K.V. Subbarao, his international collaborations with Prof. Hooper and his associates from the Columbia River basalts and the Memoirs No.3, 10 and 49 (i) and (ii) published



Fig.3. Felicitations: (a) Prof. V V Peshwa, (b) Prof. K.V. Subbarao (c) Prof. S.F. Sethna. (d) Dr. Gerta Keller and (e) Dr. P. Krishnamurthy.

by the Geological Society of India, besides his edited book on 'Volcanism'. Dr. Khadri received the citation on his behalf. This was followed by honouring Prof. Gerta Keller for her significant contributions in the Deccan inter-trappean paleobiology and constraining the spatial and temporal aspects of the K-Pg boundary. She received the honour in person and thanked the organisers for the gesture. Finally, Dr. P. Krishnamurthy was felicitated after Dr. Mohanty of the Geology Department summarised his contributions on the DVP through his work on the potassium-rich rocks of Rajpipla, the rare picritic lavas of the three Saurashtra boreholes studied previously by Dr. West and his own studies with Prof. Kanchan Pande and others on the mantle-derived spinel peridotite nodules in mela nephelinites and ijolites from Kutch and the Indo-US and Indo-USSR projects on the Deccan, besides his major review papers on the DVP in two parts published in 2020. Dr. Krishnamurthy, after receiving the felicitations, thanked the organisers and recalled his research days at Sagar and Edinburgh under his esteem Gurus, namely Dr. W.D. West, Dr. G.R. Udas and Prof. K.G. Cox. The day ended with a dinner at Hotel Pride, Shivaji Nagar, Pune.

On October 2nd, after paying respects to the Father of the Nation, Mahatma Gandhi on his birthday, Session 4 on 'Mafic-ultramafic-alkaline magmatism and entrained xenoliths' began. It had eight (8) presentations including an invited talk by Prof. N.V. Chalapatih Rao on 'Alkaline rocks and their entrained xenoliths from the Deccan large igneous province: a review of the present status'. Prof. Rao dealt with the extreme diversity of the rock types, such as nephelinites, ijolites, basanites, lamprophyres, carbonatites, pyroxenites, kimberlites, their mineralogy and the entrained xenoliths, both mantle- and lower-crustal derived from different parts of the DVP. Their ages also vary from 124-55 My. Geodynamic implications and their economic potential were also covered besides suggestions for future research. The other papers presented include the 'Olivine composition in picritic and ankaramitic dykes from Elephanta Islands, Mumbai (Azhar Shaik), Girnar complex (Mahesh Halder), Murud-Janjira lamprophyres (Anshika Singh), ijolite dykes from Palampur, Kachchh and ijolite from Sarnu-Dandali (Rohit Pandey), and geology, geochemistry and petrogenesis of the Kanesara alkaline complex from northwestern DVP (Md. Naushad), alkaline complexes of Rajasthan (Debojit Talukdar) and role of magma mixing in the petrogenesis of lamprophyres from the Nirwandh alkaline complex, Kutch (Abhinay Sharma). Critical discussions were made during each presentation.

Session 5 was on 'Deccan-hosted mineralisation, carbonatite-hosted REE and their genesis, laterite and bauxite' chaired by Prof. Santosh Kumar and Dr. Blair Schoene. It began with an invited talk by Dr. Jyothirajan S Ray on 'Carbonatites of the Deccan Large Igneous

province'. He outlined the importance of carbonatites as rocks with low viscosity and rapid ascent from mantle depths and hence are least contaminated providing information on the pristine nature of the mantle source-regions. Ray evaluated the carbon and oxygen isotope signatures of the three carbonatite localities from Amba Dongar, Sarnu-Dandali-Kamthai and Mundwara and inferred their source regions with both pristine carbon as also recycled crustal carbon through paleo-subduction zones into the mantle, corroborated from recent studies from Ca isotopes. J.V. Rama Rao of GSI, gave a talk on 'Mapping mineral belts beneath the DVP through passive geophysical methods. Ashish Dongre presented a paper on the 'Petrogenesis of the alkaline rocks and carbonatites of Sarnu-Dandali, Rajasthan'. Prashant Dhote, presented 'Contrasting style of REE mineralisation from the carbonatite-alkaline complexes in the DVP' citing examples from Amba Dongar and Kamthai. He opined that, besides other factors, an early stage of liquid-immiscibility from the nephelinite and carbonatite at Amba Dongar and a late stage of the same phenomena has been responsible for the variation and size of the REE minerals in these two complexes. The former largely with very fine grained REE carbonates (bastnaesite, parasite and others; 10-50 microns; c. 0.5%) compared to their larger size (a few mm across) and higher grades (over 1%). Mahesh Bhaise presented an account of the 'Potentiality of laterite-bauxite over the DVP from western Maharashtra'. Nilofer Shaikh spoke on the 'V-rich beach sands of Ratnagiri' while Navjeet Nayyar spoke on 'Geochemical studies of Al-V bearing laterite cappings in parts of Chandrapur, Maharashtra and Komaram-Bheem district of Telangana, Central India.

Session 6 was on 'Palaeobiology, Sedimentation and Paleoclimate including the K-Pg boundary - Part I, Chaired by Dr. D.M. Mohabey and Neloy Khare.

The invited lecture by Dr. Mohabey on 'Stratigraphic constraints on Deccan Trap sequences and associated sediments of different provinces, spatial - temporal conditions: implications for tracking biotic change'. Based on a huge collection from 250 infra- and inter-trappean localities at multiple stratigraphic levels constrained by volcanic stratigraphic sequences in Central, and Eastern DVP and the Lameta basins, including the classic Nand-Dongargaon basin, he inferred that the titanosaurid-abelisaurid dinosaurs, madtoid snakes, anguimorph-scincomorph lizards and Kurmademydini turtles appeared in C30n, coeval with the first angiosperms before the initiation of the Deccan Traps. The diversity of dinosaurs declined gradually with increasing volcanism, and disappeared some 350 ky before the K-Pg boundary. Thus, he proposed that the fossil evidence seems to negate the rapid extinction attributed due to the bolide effect at the boundary. In the special invited talk on 'The Deccan volcanism caused the KPB mass extinction: the Chicxulub impact predates the KPB by c. 200 ky', Gerta Keller, Stephen Grasby and Thierry Adatte, the authors refute the link between the meteorite impact, that came c. 200 ky before the K-Pg boundary, as a cause of mass extinction and attribute it to the massive, mega-volcanic eruptions, extreme climate warming, mercury emissions, toxicity and ocean acidification. Other papers presented include: 'Deciphering response of terrestrial flora to the Deccan volcanism, based on mega and microfloral evidence' by Bandana Samant and 'Coupling timing and tempo of Deccan volcanism with the K-Pg extinction through Hg and Te anomalies' by Thierry Adatte.

This was followed by a visit to the Poster Session with coffee break, wherein the delegates could see the posters and interact with the presenters, mostly young researchers from various Indian universities. This was then followed by a cultural programme that began with the dance invoking the blessings of Lord Ganesh. The program show-cased the Maharashtra State heritage, the vibrant culture of Marathas under Chatrapathi Shivaji Maharaj and his magnificent Forts. It also had the fusion music and dance of the classical Indian

and Western types besides some display of martial arts and festive dance. This was followed by the Conference dinner at the terrace of the Geology Department.

The final day of the Conference began with Session 7, on 'Paleobiology, sedimentation and paleoclimate including K-Pg boundary'. part II', chaired by Dr. S.F.R. Khadri and Thierry Adatte. Four papers were presented that included 'Deccan intertrappean: a proxy to the cosmic, impact and volcanic activities during the K-Pg boundary period' by V.P. Singh. Sabyasachi Mandal presented a paper on 'Altered carbon cycle and coupled geochemical pattern in Maastrichtian Lameta Formation: A record of Deccan impact on infratrappean sequence at K-Pg'. This was followed by a paper on 'Paleomagnetic signatures of the older Maastrichtian (C30n) lava flows from the Malwa Group of Deccan Trap: constraining age of associated sediments at multiple stratigraphic levels' by Anup Dhobale. The last paper in this session was by Jyotibala Singh on 'The mineral magnetic and clay mineral transition around K-Pg boundary from the Jhilmili intertrappean sediment sequence of the Deccan Traps, Mandla lobe, Chhindwara Dt., MP, India'.

This was followed by Session 8 on 'Pre-Deccan Platform: hydrocarbon potential and geodynamic influence' Part I, chaired by Dr. B. R. Arora and Dr. O.P. Mishra. Dr. Sukanta Roy, Director, BGRL, Karad gave an invited talk on 'Pre-Deccan platform and associated seismicity: constraints from scientific drilling', wherein he briefly dealt with the objectives of Borehole Geophysics Research Laboratory, established by MoES to understand the reservoir-triggered seismicity of the Koyna-Warna region by deep drilling. He informed the significance of placing equipment's to study the in situ-stress regimes (in the Precambrian basement gneisses) besides the study of Deccan basalt cores above and gneisses below for their structural stability based on engineering and seismic properties. He highlighted 'the deep drilling planned up to >3 km in the Koyna-Warna region by the MoES. His presentation shows that the downhole measurements of physical and mechanical properties, composition of formation gases, stress and temperature regime has provided new information about subsurface fault damage zones, the transitional (from normal strike-slip) faulting environment, and the presence of critically stressed, optimally oriented and hydraulically conductive fractures that offer favourable conditions for recurrent seismic activity in the region'. This was followed by a paper by Kunal Modak on 'Vulnerable fracture for future failure: insights from the study of drill core samples from the basement gneisses.... below the Traps in the Koyna-Warna region'. Pavankumar Gayathri presented a paper on 'pre-eruptive crustal electrical structure and tectonics of the recent Palghar earthquake swarm activity region, Western DVP' and linked pre-existing shear zones, such as the NW-SE trending Kurdwadi lineament and the N-S strike changes around Palghar as a possible cause. Amarjeet Bhagat in his paper 'Deccan Traps: a pantheon of geodynamics' dealt with a whole gamut of geodynamical considerations within the western Indian ocean with 'multiple spreading ridges, subduction systems, and micro-continental slivers'. The last paper was presented by Subhobroto Mazumdar on the 'Probable existence of a Mesozoic aborted rift below the Deccan Traps in the shelf part of Kerala Konkan'.

The last Session 9 on 'Pre Deccan-Platform: hydrocarbon potential and geodynamic influence, Part II', was chaired by Vivek Kale and

Matthew Balme. The invited talk was delivered by V. Yatheesh on 'Geodynamics of the Indian Plate derived from marine magnetic anomalies in the Indian Ocean since Late Cretaceous' wherein he described the marine magnetic anomalies imprinted in the Indian Ocean floor, to correlate with the timing of major geodynamic events that influenced the northward movement of the Indian Plate since the Late Cretaceous. This was followed by a talk by Amrita Ghosh on 'CO₂ sequestration in DVP: scope and challenges. A paper on the 'Prominent red bole section near Aurangabad, India: implications to understand the terrestrial analogue of clay minerals in basaltic environs of Mars was delivered by Nirmala Jain.

The Conference came to close by an invited talk by Himanshu Kulkarni of ACWADAM on the 'Groundwater-climate-disaster nexus: rethinking resilience'. Dr. Kulkarni elaborated as how the challenges of the depleting sources due to excessive drawdown, climate extremes that leads to disasters such as landslides that are related to extreme and continuous rain.

Valedictory Session

This session was chaired by Dr. Arora, Dr. Mohabey, Prof. Chalapathi Rao, Dr. Vivek Kale, Dr. Sangode and Dr. Dongre. Feedback on the Conference was sought and the following provides a summary of the suggestions for the way forward. Overall, the participants opined on the realization about the large scope of work yet to be done in Deccan traps with multiple tools, and encouraged the organizers to conduct such conference every two years. All the conveners urged the young workers to develop teams to produce new data and information on the DVP. Participants suggested to provide more time for the posters session which had a huge display of over 57 posters with many representing young teams with new data and new approaches. The organizers were highly constrained due to limited time available and large number of presentations exceeding the expected time limit. A future course of action is being discussed by the organizers and delegates over possible publication and interactive website.

Two Days Field Visit

Two days of field work in surrounding areas exposing typical volcanological features, stratigraphic formations, various physiographic elements and regional attributes were organized on 4th and 5th October. The field was guided by Dr Makrand Bodas, Dr Vivek Kale, Dr Gauri Dole and Dr Poushali Chatterjee. Two traverses were planned, south and north of Pune, covering large part of the Deccan stratigraphy. The features like GPB, lobe morphology and various flow types were described. A visit to Core Library of MoES- BGRL at Karad further displayed the rare features encountered in the borehole cores for Deccan traps and the basement rocks. Dr Sukanta Roy organized the visit and elaborated the facility at BGRL.

The organisers specially thanked all the Government funding agencies such as the Ministry of Earth Science, New Delhi, National Centre for Earth Science Studies, Trivandrum; Department of Science and Technology, New Delhi; Indian Institute of Tropical Meteorology, Pune and Oil and Natural Gas Corporation besides several private agencies. Large number of PhD scholars and all the faculties of the Department of Geology of SPPU were specially thanked for the successful completion of the conference.