ACTA SCIENTIFIC AGRICULTURE (ISSN: 2581-365X)

Volume 3 Issue 6 June 2019

Review Article

Studies on Discovery of Rare Gas Helium in the Petroliferous Tube Wells in Saugor Upper Vindhyan Rocks, Sagar Distt. in Southern Ganga Basin, Bundelkhand Region, M.P. India

Arun K Shandilya[1]*, Anupam Shandilya[1], Ankita Srivastava[1], Bhargava Iyengar[2] and Satyam Singh[3]

[1]*Department of Applied Geology, Dr. Hari Singh Gour University, Sagar, M.P, India*

[2]*Department of Mining, MATS University, Raipur, India*

[3]*Mineral Resource, Raipur, India*

***Corresponding Author:** Arun K Shandilya, Department of Applied Geology, Dr.Hari Singh Gour University, Sagar, M.P, India.

Received: March 18, 2019; **Published:** May 20, 2019

DOI: 10.31080/ASAG.2019.03.0488

Abstract

The studies on the exploration of helium gas in the petroliferous tube wells in Sagar Distt. Southern Ganga Basin, Bundel- khand region has been carried out in great detail in 50 Tube wells, with a joint collaboration of Dr. Hari Singh Gour University, Sagar and ONGC Energy centre Laxmi Nagar New Delhi. As per the discovery of Helium gas and methane gas is leaking through more then 50 tube wells, containing good remarkable amount of Helium is 0.34% to 0.732% and methane 72% to 99%. These investigation were done in the long period of research dedication (more then 20yrs). It has been found in the stable isotope d C13 value, the values for the methane is - 43.6 per mil w.r.t. to - 54.9 per mil w.r.t. PDB and for the Ethane gas is -24.9 to -26.4 per mil w. r. t. PDB in the gas samples. The research findings have been published in the journal of National and international repute, which has attracted not only ONGC, ONGC Energy Centre, Atomic Mineral Directorate, scientists of Bhabha Atomic Research centre, Mumbai, C.G.W.B., Faridabad and many others.

The ONGC Energy centre, Ahmadabad has started the detail collaborative work through exploratory drilling, under this 600 m deep drilling have to be carried out in various location, from where the gas leakages has been reported earlier. After 600 m deep bore hole, the detail geophysical logging including the Gama ray logging, Neutron logging, litho logical and structural logging, stable isotopic analysis etc will be carried out to know the type of probable reserve of these gases and what depth, we can get the gas for the exploitation and utilization in these The ONGC energy centre Ahmadabad has started the detail collaborative research work, through 600 gases for the Industrial purposes and other uses. The detail geophysical studies will be very much helpful in the gas reserve calculation and the depth of gas pockets in the south Ganga Basin, around Sagar area.

Keywords: Petroleum, Helium; Vindhyan Rocks; Stable Isotopic; Thermogenic; Methane; Ethane; Geochemical; Hydrocarbon; Stable Isotopic; Geophysical Logging

Introduction

The present studies on the hydrocarbon gas anomalies in the seepages and leakages of natural petroleum rare gas Helium gases in the agricultural field of Sagar and Damoh district has been done in the hydrocarbon rich zone. These hydrocarbon gases and helium gas were escape from the reservoir and migrated to the surface, the secondary porosity in the rocks, sediment and soil or diffuse into the atmosphere or added in the ground water. These leakages of natural gas is an indication of petroleum gas in the form of oil and gas seeps from precursor under ground.

The attempt has been made through the cheaper and faster method of geochemical prospecting, which provides the direct evidence for the presence of petroleum accumulation under ground. The samples of soil, water and gas were collected from the tube wells of agricultural field are located in the agricultural field of various villages in the Meerkheri, Rahatgarh (tahsil) Pipariya –Bhutoli villages in Garhakota tahsils of Sagar and Mahalwara village in Sukha block of patharia tahsil of Damoh distt. in the southern fringes of Bundelkhand region in M.P. The first time leakage of petroleum gas was reported in 1980 from the Meerkheri village located on the Sagar to Vidisha road, at about 15 km from the Rahatgarh town. In 1993, in another tube well at Rahatgarh the leakages was reported by the author.

Figure 1

The carbon isotope studies of methane and other gases were done to know whether these petroleum gases are of biogenic of thermogenic origin. Coleman., *et al*. [1] in a study on the leakage of gas from the underground storage reservoir, showed that isotopic analysis is a reliable technique for differentiating between methane from thermogenic and biogenic source. A useful geochemical method to correlate gases with their source rocks is δC^{13} determination. The isotopic composition of methane was found to be a more reliable indicator of hydrocarbon reservoir. Shandilya [2] has reported the occurrence of the petroleum gas in the Sagar District and suggested that theses petroleum gas is of thermogenic in origin.

Shandilya [3-6] made Discovery of Natural Gas leakages from Bore wells in the rocks of the Vindhyan Super group in Sagar and Damoh Distts. M.P. and forecasted the reserve of Natural Gas Reserves in Sagar District. Shandilya [7-9] published an article on GAS IN THE BACKYARD. in the BUSINESS INDIA MAGZINE suggesting that this gas is of thermogenic origin. Shandilya [7-9] has suggested the possibility of Petroleum Gas reserve in Southern Bundelkhand Region. M.P. Shandilya, and Gajbhiye [10] made the Discovery of Rare Helium Gas in Sagar Distrcit, M.P.

Prasanna., *et al* [11] were done the detail investigation of light gaseous hydrocarbon anomolies in the surface soil around Sagar using the geochemical exploration methods for hydrocarbon leakages has been focused on the detection of absorbed petroleum gases by gas chromatohraphic method, in Vindhyan basin using composition and ratio of the light hydrocarbons methane, ethane, propane, butane.

Geology

The present natural gas leakages have been discovered in the dried tube wells, located on the rocks of Sandstone, shale and limestone rocks of the Rewa and Bhander Group of the Vindhyan Super Group as the basement rocks. These petroliferous rocks are overlain by the Lameta bed (late Cretaceous) in the western part of the Pipariya and Bhutoli area in Garhakota tahsil. On the western part of present area is overlain by the rocks of Upper Cretaceous Deccan Trap Basaltic flows, which are intercalated with intertrappean

limestone. The area were the leakages of petroleum gas has been discovered located on the alluvial soil cover. The Deccan Trap Basaltic rocks are exposed west of the Chinnoua village in Garhakota Tahsil. The dips of the sandstone and shales rocks are 10 - 15 degree toward SE direction. The topography is more or less flat with some low lying areas near the stream. The geological formation of Sagar area consists of 09 flows of Deccan Trap.

Figure 2

With several intertrappean limestone beds, whole area being underlain to the east and south by the Lameta limestone. which forms the plains and some hills to the south.

Western fringe of The Rahatgarh and Meerkheri areas are covered mostly by the Basaltic flows of Deccan Traps except few inliers of the shale and sandstone rocks of Rewa Group and Bhander Group of the Vindhyan Super Group. The Deccan Trap basalt rocks are mostly covered by the black soil. The Decan volcanism during late Cretaceous must have generated the proper thermal conditions and acted as a catalyst in triggering Mesozoic hydrocarbon generation processes in the Vindhyan sedimentary basin in Central India.

Age	**Formations**
Recent Sub Recent/Quaternaries.	Alluvium soil Black soil
Upper Cretaceous	Deccan Trap Basalt (with Intertrapean limestone)
LoLower Cretaceous	Lameta Formation
Late Proterozoic Vindhyan Super Group	Bhander Rewa (Containing the Petroleum gas and Helium gas) Kaimur Semri
Middle Proterozoic Bijawar Super Group	Phosphatic Dolomite Dolomite. Ferrugenous Shale Ferrugenous Sandstone Iron Formation/BHQ Quartzite Conglomerate bed.
Early Proterozoic Bundelkhand Granite Complex	Quartz reef intrussion Pegmatitic intrussion Ultramafic intrusive Granite Intrussive rocks. Granite Gneiss Biotite Schist.
Archean Mehroni Super Group	Intrussive body Dolomitic Marble Slate Ferrugenous Formation Quartzite Schist

Table 1: The stratigraphic succession in Sagar.
(Modified after Rang rajan 1978)

Observation

On the request of authors, the Director Exploration, KDM IPE, ONGC Dehradun and Director, NGRI Hyderbad has sent a team of scientists for the detailed investigation had visited the Piparia-Bhutoli and Rahatgarh and Meerkheri area and collected the samples of soil, water and gas. The samples were collected from the following localities.

Bhu-1: These tube wells fall under the panchayat and P.O. chanauaa tahsil Garhakota dist. Sagar, M.P. (part of survey of India toposheet no. 55M/1) It is accessible by a 3 km Village road from town Garhakota around 45 km East of Sagar on way to Damoh. The leakage of petroleum gas is reported from 08 tube wells in the month of march 2007.

These bore/tube wells varying in the depth from 260 to 400 ft, with top 60 ft is of 8" diam with plastic casing, and rest of well is of 6" diam. depth 340 feet) of Shri Bhagwan singh Yadav (lat: 23°47'59.2"N, long 79°05'29.6" E, Elevation 448m).

Pip-1: The tube wells (depth 400 feet) of Sri Asharam Patel S/o Sri Ghappu Patel (lat: 23°48'20" N, long: 79°50'20.7" E, elevation 450m).

Rah-1: This village is located 40km west of Sagar on way to Bhopal Road. In the bore well of Shri Leeladhar Tiwari (Tiwari Dhawa: lat: 23°57'15.7" N, long: 79°25'03"E, Elevation 484m), the tube well is situated on the deccan trap - Vindhyan contact. The leakage of petroleum gas is reported since 1993.

Mee-1: This tube well (lat: 23o45'56"N, long: 78o18'9.6"E, Elevation 440m) from where gas seepage was occurring belongs to Shri Dhan Singh. The area falls in the toposheet of India No. 55 I/5. This tube well is the eastern extremity of village meerkhedi, 13 km of Rahatgarh on way to Vidisha. This tube well pouring the petroleum gas sinse 1984 having enormous bubbling in the water. The tube well is located on the contact of daccan tram basalt and vindhyan sandstone (Inlier). The quantity of petroleun gas bibbling ins increase day by day.

Mah-1: The leakages of the petroleum gas has been reported in 2009 from this village in Patharia Tahsil of Damoh district. The 378 feet deep tube well is pouring the water alongwith the natural petroleum gas and the water which is coming out of the tube well is burning upto 2-3 feet long flame. In the borewell of Sri Halle singh Lodhi at Mahalwara about 11 km north of Patharia railway Station in Damoh Distt. Is also containing the leakages of petroleum gas in the 378 deep tube well, which was digged in Nov.2008. The tubewell water getting fire, when light up the matchstick about 1.00 m high flame burning in water. The pertoelum gas is also coming out of the tube well when no pumping is done, the leakage of the gas can be easily seen in it.

Bat-1: It is located about 25 Km from Damoh. In the tube wells the water gives the smell of kerosene/diesel in the month of Nov.-Dec. 2008 on word. The tube wells are varying ibn depth from 350 to 400 feet in the Vindhyan Limestone rocks.

Pat-1: In this village the tube well is situated in the inliers of the Vindhyan.

Rocks among the Deccan Trap cover, the tube well was digged in 2000, and depth id about 380 feet. It is also pouring the natural petroleum gas as it was reported in Nov. 2011.

SUK-1: In the agricultural field near the Limestone qrarry of Narsingh garh Cement (Heidel berg Cement Plant) there is a leakages of petroleum gas along with water. Reported in Dec.2009.

Man1: A tube well situated in the Deccan trap rocks in MandiBamora, depth is 390feet, digged in May2012 a;so pouring the natural gas alongwith water. The flame of 8-10 feet was observed at the well site in the Public Health Centre at Mandi Bamora. The thickness of the Deccan trap in very low at the site, resting over the rocks of Vindhyan Super Group, in the northern most extend of the Deccan cover.

Kon-1: At this village the tube wells are also pouring the gas during the month of Nov. and Dec. and the water is giving the smell of the kerosene in it. It is situated on the rocks of the Vindhyan Super Group.

Jhi-1: The tube well is situated on the inlier of the Vindhan rocks. The tube well was digged in Deccan trap rocks, which has overlying the rocks of Vindhyan Sruper Group. The depth of tube wells is varying from 300- 400 feet.

Ban-1: In this village the leakages of the natural petroleum gas have been reported in March 2012, from a tube wells which is about 360 feet deep. The gas with more speed in coming in the afternoon hour and with bubling sound fron the tube wells.

Gho-1: The Gho-1 falls in the Banda Tahsil of Sagar District. About 25 Km from Banda, on way to Patharia. In this village there are six (06) tube wells pouring natural gas along with the water. Two hand pump are also leak aging this petroleum gas and burning day and night, with the help of the local administration the fire has been controlled on 7th May 2012. The continuous gas leakage has been reported from this village. In the agriculture field of the villagers. the tube wells were diggfed in different time, but all of them are pouring the natural gas, which is burning 6-8 feet long flame.

The experiment of the gas leakages was done in some of the old tube wells, in which the natural gas in coming along with water which buning, one can say that there is water in burning (Paani me Aag).

Geochemical analysis

At ONGC Dehradun: The samples were analysed in the geochemical laboratory of KDM IPE Kaulagarh Road, ONGC, Dahradun. The finding of the geochemical analysis of the natural gas, water, and soil are as follows in table 2.

The Oil and Natural Gas Commission Dehradun has concluded with, the seepaged gases of Pipariya Bhatoli and Rahatgarh are predominantly methane (72.14%-84% in Pipariya Bhutoli and 99% in Tiwari Dhaba, Rahatgarh Bore well and are devoid of higher hydrocarbons. the hydrocarbon gases seem to have predominance of

bacterial methane. The pressure of both the seepages is extremely low. As per the owners, the quantity of gas is diminishing day-by-day. The results this time of methane is concerned. Genetically the seepage gases from Pipariya Bhatoli and Rahatgarh seem to be different from thermogenic gases encountered in exploratory well jabera-1, drilled by ONGC in Distt. Damoh (M.P.).

S.N.	Bore Well	Chemical Composition % (v/v)						Isotopic Values (δC^{13})
		He	O_2		CO_2	C_1	C_{2+}	δC^{13}
1	Pipariya Bhatoli	0.34	1.6	24.87	0.93	72.14	0.01	-61.5
2	Rahatgarh	0.72	0.65	14.37	0.28	84.00	0.02	-54.0

Table 2: Geochemical Composition of Natural Gas and stable Isotope values.
(After Shandilya2007)

In January 2008 in Bhutoli village further land owner bore the well up to 400 ft. deep there is huge quantity of natural gas has been reported to governmental agencies.In the Fab.2008 two villagers at Pipariya- Bhutoli have drilled two more tube wells upto the depth of 300- 350 feet about 600-700 m away from the earlier wells in the shales and sandstone rocks of Lower Bhander they could not got the ground water, but there is leakages of natural gas, which is also giving the blue flame.

At NGRI, Hyderabad

The samples of petroleum gas, soil, water were also collected by the scientists Dr.A.M. Dayal, Dr.Ravi Srivastava, and Dr.D.J.Patil of NGRI Hyderabad alongwith the author on 4-5 May 2008.The detail geochemical and stable Isotopic studies of the natural petroleum gas, soil and water sample has been done in the Laboratories of NGRI.

Location	Name of petroleum gas	Stable isotopic value δC^{13}
Piparia - Bhutoli	Methane	-43.6 per mil w.r.t. PDB
	Ethane	-24.6 per mil w.r.t. PDB
Rahatgarh - Mirkheri	Methane	- 54.9 per mil w.r.t. PDB
	Ethane	- 26.4 per mil w.r.t. PDB

Table 3: Stable isotopic value of hydrocarbon gas in Sagar district M.P. INDIA.
(After Shandilya 2008)

The presence of the ethane gas in both the Localities, and δC^{13} value in the range of -.249 per mil. w.r.t. P.D.B. and - 26.4 per mil.w.r.t. P.D.B. indicate the thermogenic source of these gases. On the basis of the geochemical and stable isotopic studies of the natural petroleum gas, soil and water suggest that the samples of the Piparia-Bhutoli-Rahatgarh-Meerkheri of Sagar District containing 72% to 99% of methane,0.34% -0.742% of Helium, along with the oxygen, carbon dioxide and Nirogen gases. The stable isotopic δC^{13} value in the range varying from -43.6 per mil. w.r.t PDB for methane -24.66 per mil. w.r.t PDB for ethane at Piparia –Bhutoli to-54.9 per mil.w.r.t PDB for methane and per mil. w.r.t PDB for at Rahatgarh are indicative of the THERMOGENIC origin and also that methane Is associated with oil. Bernard () suggested a geneticdiagram by correlating C1/ C2+C3) ratio with δC^{13} 1 concentration of methane to classify natural gas types. Molecular ratio C1/C2+C3 less than 50 are typical for the thermogenic hydrocarbon gases with δC^{13} value between-30% and -55%(PDB). This suggests that most of the samples fall in the thermogenic range.

The gas result indicate the presence of methane, ethane, propane and butane in Sagar District M.P. The carbon isotope studies suggest that these seeped hydrocarbon are of thermogenic origin and petroliferous in nature and indicate the area is warm for hydrocarbon exploration area [12-23].

Conclusion

In my opinion the natural petroleum and helium gas are containing the higher amount of Methane (72-99%), and remarkable content 0.34% to 0.742% of Helium, and minor amount of oxygen, nitrogen, and carbon di oxide, it suggests that it must have been formed at higher temperature condition at deeper horigen in the Pre-Cambrian Vindhyan sedimentary basin (Proterozoic in age). The reservoir must be lying below the ground at least 500 m or more deep level. The present leakages of natural gas releasing

through many hairline cracks/ fracture and feather joints in the sandstone, shales and limestone rocks of the Rewa and Bhander group rocks of the Vindhyan Super Group.

As per the geochemical and stable isotopic studies of Gas samples analysed at NGRI. find out the methane and ethane gas. The presence of ethane gas collected from the above mentioned localities and the δC^{13} stable isotopic value in the range of -24.9 per mil.w.r.t. per mil to - 26.9 per mil w.r.t. PDB. indicative of the Thermogenic sources.

Acknowledgement

The authors are thankful to the Director, NGRI and Dr. A. M. Dayal Asstt. Director of NGRI Hyderabad, and the Director, KDMIPE, ONGC, Dehradun for the Geochemical and Stable isotopic analysis of the various samples. The author is highly thankful for the critical comments and valuable suggestions on this manuscript by Prof. R.P. Tiwari Vice chancellor, Dr. H.S.G..University, Sagar and Prof. P.S. Saklani, Ex, Vice Chancellor, HNB Garhwal University, Srinagar Garhwal and Prof. S.P. Banarjee and Prof. K.S Pitre, Deptt. of Chemistry, Dr. Hari Singh Gour University, Sagar. M. P.and Prof. D.M. Banerjee, Delhi University for their valuable comments and suggestion on manuscript.

Bibliography

1. Coleman DD., *et al*. "Isotopic identification of leakage gas from underground storage reservoir- a progress report III". *Petrology* 111 (1977): 1-10.

2. Shandilya Arun K. Natural Petroleum Gas found in Piparia-Bhutoli- Rahatgarh in Sagar District, Bundelkhand Region M.P. University Journal- Madhya Bharati 53 (2007): 122-124.

3. Shandilya Arun K. "Discovery of Natural Petroleum gas in the rocks of the Vindhyan Super Group in Sagar Distt. Bundelkhand Region, M.P'. *Quarterly Journal of the Royal Meteorological Society* 16 (2008a): 24-27.

4. Shandilya Arun K. FUEL HO - Leakages of Gas in Tube wells spew natural gas. The NEWS MAGZINE mach (2008b): 31-32.

5. Shandilya, Arun K. "Natural Gas leakages from Bore wells in the rocks of the Vidhyan Super group in Sagar and Damoh Distts. M.P". *Himalayan Geology* 29 (2008c): 174 175.

6. Shandilya Arun K. Natural Gas Reserves in Sagar District. "SRUJUN" University News Letter 9 (2008d): 19.

7. Shandilya Arun K. GAS IN THE BACKYARD. in the BUSINESS INDIA MAGZINE (2009a): 144.

8. Shandilya Arun K. "Thermogenic Petroleum Gas found in tube wells of Sagar District. M.P. Madhya Bharati, Diamond Jubilee". (2009b): 314-319

9. Shandilya Arun K. "The possibility of Petroleum Gas reserve in Southern Bundelkhand Region. M.P". University News Letter, Vishwavidyalaya Samvad. 2 (2009c): 3.

10. Shandilya Arun K and Gajbhiye NS. "Discovery of Rare Helium Gas in Sagar District, M.P. INDIA". Proc. V th Inter.Conf., South Valley University QENA, EGYPT (2010): 26-30.

11. Prasanna MV., *et al*. "Light gaseous hydrocarbon anomalies in the near surface soils of Sagar District, Vindhyan Basin, India". *Current Science* 99 (2010): 1586-1590.

12. Bernard BB. "Light Hydrocarbon in Sediments". Ph.D dissertation. Texas A&M University, USA (1978): 144.

13. Fuex AN. "The use of stable carbon isotopes in Hydrocarbon exploration". *Journal of Geochemical Exploration* 7 (1977): 155-188.

14. Lones VT and Drozd RJ. "Prediction of oil and gas potential by near surface geochemistry". *AAPG Bulletin* 67 (1983): 932-952.

15. Horvitz L. "Near surface evidence of hydrocarbon movement from depth problems of petroleum migration". *AAPG* 10 (1979): 241-269.

16. Rajrajan K. Geology of Sagar district and western part of Damoh distt. Memoirs, GSI, 109 (1978).

17. Raina and Tiwari. Unpublished report of ONGC 2007 (2007).

18. Shandilya Arun K. The Discovery of natural petroleum and Helium gas in Tube wells of Sagar- Damoh Distt. in Vindhyan Rocks, M.P. Proc. Sedimentary Basins of India, Gondwana Geological Society, NAGPUR (2011): 125-130.

19. The News of Discovery of Petroleum gas was published in News papers: Dainik jagran, Dainik Bhaskar, Raj express, Nav Bharat, Nai dunia, Hindustan times, Acharan etc.

20. Shandilya Arun K., *et al*. "Hydrocarbon gaseous anomalies found in Agriculture Field around Sagar and Damoh Distt. Southern fringes of Bundelkhand region, M.P". *American Journal of Life Sciences* 1.3 (2012): 1039-1044.

21. Shandilya Arun K. Studies on Helium and Natural gas anomalies in tube wells around southern Ganga Basin, Bundelkhand region, M.P. India. In Book-Management of Water, Energy and Bioresources in the Era of Climate Change. Ed.-N.Janardhan Raju, Wolgane, Ramanatha and M.Sudhakar. Capital Publ. House, New delhi. (2013): 154-160.

22. Shandilya Arun k and Shandilya Anurag. "Helium and petroleum gas found in rocks of Vindhayn Super Group, south Ganga basin, Bundelkhand region, M.P. India". Proc. III Inter. Conf. on Petroleum Science and Technology (ICPST2014) IIT Madras 3 (2014): 26.

23. The News of Discovery of Petroleum Gas was broad casted in T.V. Channels : - Door Dhashan (DD) state and National both, Sahara National, India T.V., ETV, Times, and Aaj Tak, Khabar Bharti, and P-7 TV channel.

Volume 3 Issue 6 June 2019