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GEO-CHEMICAL CONSTRAINTS OF ANAKDEV (DARA) HOT SPRING OF SHAHADA IN MIDDLE TAPI VALLEY, NANDURBAR DISTRICT OF MAHARASHTRA, INDIA

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Abstract- Middle Tapi valley belongs to Jalgaon, Dhule and Nandurbar districts of Maharashtra state hosts nine hot springs. Geo-structurally, they are situated along the dolerite dyke, faults and fractures. Geologically this area comes under the Deccan Trap province. They are almost parallel to the strike line of southern Satpura foot hill or Tapi valley lineament. The geothermal water emerges on the surface through these dykes, faults and fractures. The water gets heated due to the geothermal gradient of interior of the earth. Anakdev (Dara) hot spring is perennial. The discharge of water from hot spring is constant with discharging rate 44 l/minute throughout the year. The temperature of hot spring fluctuates 50°C.

The chemical characteristics of thermal water discharged from Anakdev (Dara) hot spring is sodium Chloride type. The source of the saline component (Cl) is attributed to ancient formation waters trapped in the geological formations, or magmatic or hydrothermal fluids. The percentage of total cation and anion (Na-HCO_3) is found to be a good indicator of hotness of water discharging from spring. The concentration of SO_4 ion in the hot spring waters is small. This unusual concentration reveals that the origin of SO_4 ions in the hot spring water is related topyrite (FeS_2) minerals in the rock formation. The recent occurrence of rise of water of this hot spring may be related to the recent interior activities of this area.

Keywords- Tapi Valley, Anakdev Hot Spring, Satpura hills, Deccan trap, Geochemistry

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Introduction

Middle Tapi valley covers Jalgaon, Dhule and Nandurbar districts of Maharashtra state hosts nine hot springs. Geo-structurally, most of them are situated along the dolerite dyke, faults and fractures. Geologically this area comes under the Deccan Trap province. They are almost parallel to the strike line of southern Satpura foot hill or Tapi valley lineament. The geothermal water emerge on the surface through these dykes, faults and fractures. The water get heated due to the geothermal gradient. Anakdev hot spring is one of perrineal amongst them situated on dolerite dyke to the North of Tapi channel. Its astronomical location is 21°42' N - 74°27' E.

Anakdev is well defined hot spring in this area and referred by various name like Dara, and Unapdev. It discharges hot water at a constant rate of 44 L/minute. The annual mean temperature of the water is 50°C. The seasonal fluctuation of temperature is 5°C. However, this hot spring experience gradual rise of temperature. Recently rate of rise of temperature is slightly accelerated. This might be the indication rate increase of interiors activities below this hot spring. Therefore

The aim of this paper is to attempt the investigation of geology, structure, chemical characteristics and its geothermal manifestation. The Anakdev is selected on the basis its merit potential to such study.

Objectives

i. The above aim is served by the following objections.
ii. To understand geostructure of the Anakdev hot spring.
iii. To analyse chemical composition of water discharging from hot spring.
iv. To analyse the change in temperature seasonal or gradual rise of temperature since long and recent accelerated rise of temperature.

Study Area

Anakdev hot spring is located at Dara village in the vicinity of Shahada city. It is about 24 kms to north of Shahada Taluka headquarter in the district of Nandurbar in Maharashtra State (India). Astronomically it is located on 21°42'N lat. & 74°27'E long. Its site is on the dyke crossing the Susari river channel.

Methods and Materials

Anakdev is frequently visited by us since 1998. The change in temperature noted during our visit. Recently the water samples collect-

ed for three seasons during 2007-2010 and analysed for chemical composition in the laboratory. The parameters used for are pH, TDS, Total hardness, Cations, Anions and temperature [Fig-1].

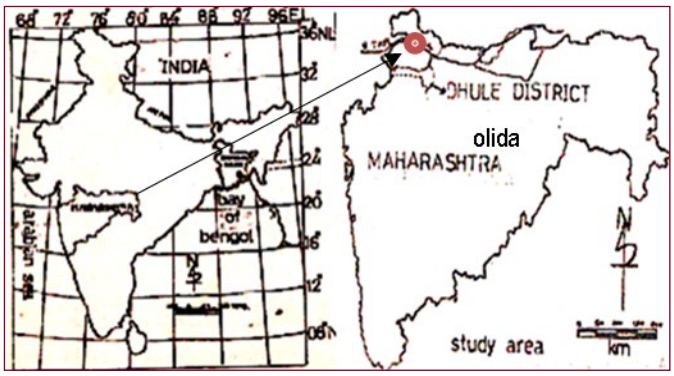


Fig. 1- Study Area

Geological Set Up

Anakdeo hot spring located within 24 km from Shahada of Nandurbar district. The entire Nandurbar district covers two major geological formations [Fig-2]. The Deccan trap formation with subsequent dykes and alluvial formation.

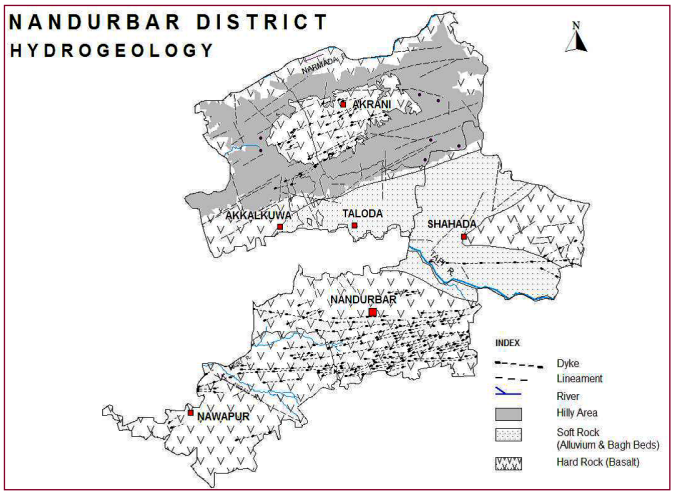


Fig. 2- Hydrogeological map of Nandurbar district

(*Source: Ground Water Information Nandurbar Dist. Maharashtra*)

Anakdeo hot spring is situated in the northern side of River Tapti. The area around this hot spring is mainly covered by trap flows, pre-dominantly of pahoehoe type. The flow shows northerly dip varying between 9° & 12° and area induced by doleritic dykes trending N 75° E- S 75° W to E-W [Fig-3].

The thermal spring of Anakdeo (Dara) issue through the northern margin of 8.0 M. wide dyke, trending almost E - W. The dyke has prominent chilled margins. In the south part of the area examined around the thermal manifestation, thick pile of consolidated to semi-consolidated alluvium consisting of angular to sub angular pieces of basalt and calcareous matter cemented in clay matrix is seen. A prominent shear zone is traceable to the NNE of the hot spring over a long distance it has E-W trend and is about 20 M. wide. The flows either side of this zone are same. The shear zone is made up to highly crushed basalt which is cleared in to this plate. The predominant joints in the area along E - W, S 35° E and N 35° E - S 35° W. The surface temperature of thermal water is 54°C and the rate of discharge is 0.7 lit/sec.

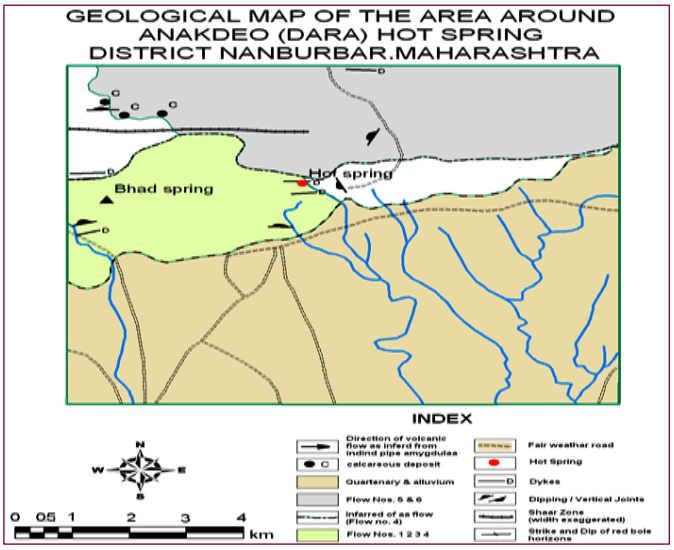


Fig. 3- Geological Map Of The Area Around Anakdev Hot Spring

Plate 1- Origin of Anakdev hot spring

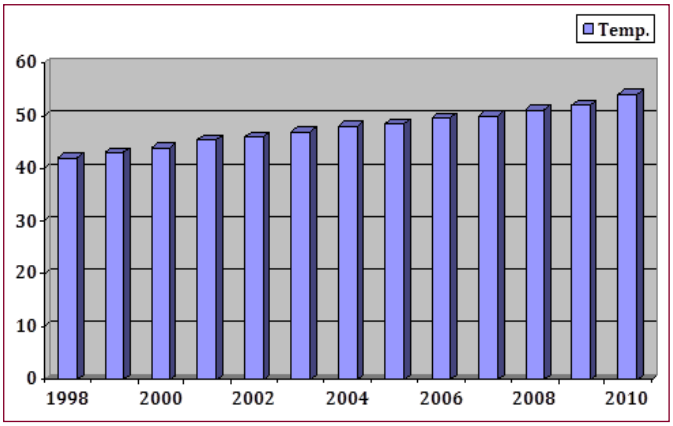
Plate 2- Dyke crossing the river channel near hot spring

Temperature of Anakdev Hot Spring Water

Temperature of hot spring water in middle Tapi basin is not uniform whole year; it fluctuates from season to season. The water is comparatively hot in summer season (May) than in rainy season (Sept) because of the low mixing of water at its source. In rainy season mixing of underground water is comparatively higher at source. So that temperature decreases. The temperature variation of hot spring water is shown in [Table-1] the temperature varies is in increasing ratio. This variation is illustrated in following graph.

Table 1- Yearwise Temperature of Anakdev hot spring

Year	Temp.°C	Year	Temp.°C	Year	Temp.°C
1998	42	2003	47	2008	51
1999	43	2004	48	2009	52
2000	44	2005	48.5	2010	54
2001	45.5	2006	49.5		
2002	46	2007	50		



Graph 1- Temperature variation of Anakdev hot spring

Table 2- Chemical Composition of the Collected Water Sample of Anakdev hot Springs

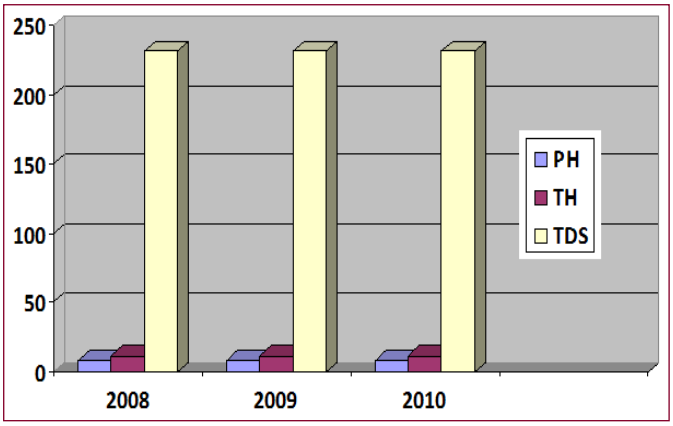
Year	Temp. °C	Ph	TH	TDS ppm	Na Mg/l	K Mg/l	Mg Mg/l	Ca Mg/l	CO_3 Mg/l	HCO_3 Mg/l	Cl Mg/l	SO_4 Mg/l
2008	51	8.4	11.8	231.7	43.2	0.2	0.6	3.5	18.3	26	44	Tr
2009	52	8.5	11.9	231.8	44.1	0.3	0.7	3.7	18.6	26.4	44.1	Tr
2010	54	8.6	12	232	44.9	0.3	0.8	3.8	18.8	26.6	44.2	Tr

Chemical Characteristics of Anakdev Hot Spring

pH- The pH value of Anakdev hot spring water is 8.4 which indicates that water is alkaline in nature.

TDS- The amount of TDS of hot spring is 232.0 ppm. The salinity is directly proportional to TDS. The TDS value of Anakdev hot spring shows saline nature.

Total Hardness- TH means the total hardness of the hot spring. The hot spring of Anakdev has low value of hardness i.e. 12.0 ppm. The hardness is based on various cationic and anionic proportions in the hot spring water.

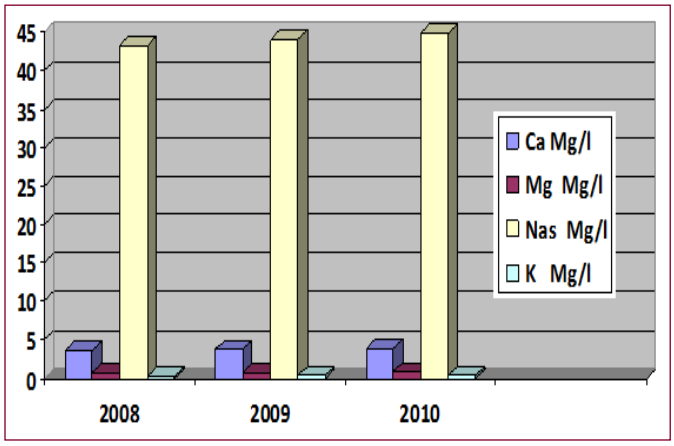


Graph 2- pH, TDS, TH variation of Anakdev hot spring

The cation like Ca, Mg, Na, K and anion like CO_3, HCO_3, Cl, SO_4 etc. have been attempted.

Cationic Classification

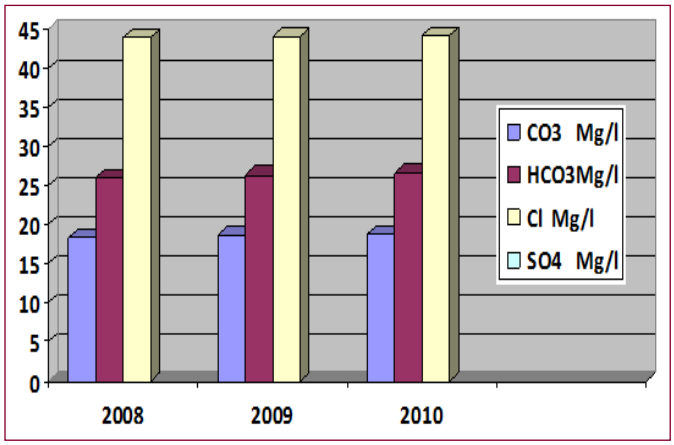
On the basis of cationic concentration i.e. composition of alkalies and alkaline earth metal. It reveals that the proportions of (Na+K) are greater than (Ca+Mg). In pair of Na+K the proportion of K is negligible as compare to Na, thus on the basis of highest cationic proportion the hot springs can be categorized as a Sodium type.



Graph 3- Cationic variation of Anakdev hot spring

Anionic Classification

The maximum concentration of CO3 is in the hot spring of Anakdev i.e. 18.8 ppm. The reason behind maximum concentration of Anakdev might be associated with the lithological characteristics of the nearby area of Anakdev which is bounded by several parallel as well as vertical dykes. The concentration of the HCO_3 is found less in the case of Anakdev hot spring (26.6 ppm).



Graph 4- Anionic variation of Anakdev hot spring.

Classification on the basis of cationic and anionic combination, the Anakdev hot spring can termed as Sodium Chloride type

Conclusion

Anakdev hot spring discharge hot water can be defined as the spring water is at least appreciably warmer than the surroundil/s with temperature of 50°C. The hot water emerge from the fractures in the dolerite dyke exposed in northern river channel of Tapi. It is heated by geothermal gradient. The estimated temperature of this hot spring 108°C. The ph of hot spring water is slightly alkaline. However in the basis of anionic and cationic concentration it is sodium Chloride type.

Conflicts of Interest: None declared.

References

[1] Acharyya S.K., Kayal J.R. and Chaturvedi R.K. (1998) *J. Geo. Soc. India*, 51, 295-304.

[2] Dutta A., Gill G.K.S., Srinivasan J. (1983) *Geo. Sur. of India*, Spec. Pub. No. 8 Sec. III.

[3] Bhamare S.M. (1987) *Geomorphic Analysis of Panzara Basin* (*Maharashtra*), Unpublished Ph.D. Thesis submitted to University of Pune.

[4] Choubey V.D. (1971) *Bulletin of Volcanology*, 35, 660-685.

[5] Dubey R. (1984) Unpub. Geol. Surv. Ind. Prog. Rept. F.S. 1981-82.

[6] Chandrasekharam D., Mahoney J.J., Sheth H.C., Duncan H.C. (1999) *Journal of Volcanology and Geothermal Research*, 93, 111-123.

[7] Deshmukh S.S. and Sehgal M.N. (1988) *Geol. Soc. of India Memoir*., 10, 323- 340.

[8] Dubey R. (1984) *Geol. Surv. of India* 1981-82.

[9] Gupta M.L. (1993) *Earth and Planetary Sci. Letters*, 115, 275-285.

[10] Guha S. (1995) *Indian Minerals*, 49, 61-78.

[11] Gaonkar S.G. and Srirama B.V. (2003) *Geol. Mag*., 5, 213-227.

[12] Hartmann J. & Levy J.K. (2005) *Nat. Haz*., 34, 279-304.

[13] Jain S.C., Nair K.K.K. and Yedekar D.B. (1995) *GSI Spec. Publ*., 10, 337-371.

[14] Sahu R.N. (2010) *Applications of Geothermal Resources of Tapi Valley to Generate Electricity Using Binary Liquid Technology*, Proceedings of World Geothermal Congress, Bali, Indonesia.

[15] Sharma S.K. (2010) *Geothermal: a sustainable energy outlook for India*, Proceeding world geothermal congress 2010, Bali, Indonesia.