KOPPAL DISTRICT

KARNATAKA STATE

FIG.20 KOPPAL DISTRICT

1. Location

Koppal district is located in the northern half of Karnataka State and has geographical area of 5,580 sq. km. It is bounded by Bagalkot district on northwestern side, Gadag district on the western and southwestern side, Bellary district on southern and eastern side and Raichur district on northeastern side. It lies between 75^0 57' to 76^0 41' E Longitude and 15^0 08' to 16^0 01' N Latitude.

2. Demography

According to the 1991 census, Koppal district has a total population of 958,078. There are 709 habitations / villages. Koppal is the district Headquarters and is the only major city in the district. Koppal district has four taluks viz., Gangavati, Koppal, Kushtagi and Yelburga.

3. Climate, Drainage and Soil

Koppal district falls under Tungabhadra sub basin and is drained by Tungabhadra River and its tributaries. Tungabhadra River acts as the border between Koppal and Bellary districts. Parts of Koppal and Gangavathi taluks are covered under Tungabhadra command area. A major dam has been constructed across Tungabhadra River in Hospet-Munirabad sector. The area essentially receives the rainfall from southwest monsoon during June to September, spread over around 30 rainy days. The average annual rainfall in the district is around 600 mm. Koppal district forming part of the maidan region has degraded scrub forest. Generally, Koppal district experiences dry climate with temperature varying between 22 to 40^0C. The highest maximum temperature is in May, which is the warmest month over major part of the state, reaches 43^0C in Koppal district. Koppal district is covered by red gravelly and kankary soil and is grouped under northern dry zone of ten fold Agro-Climatic classification of Karnataka.

4. Geology and Groundwater occurrence

Koppal district consists of the basement gneisses (Peninsular Gneissic Complex, PGC) covering major portion. Overlying the gneisses are the Closepet granite/ Syenite. From the groundwater point of view the rocks are classified as crystalline formations. The fracture / fissure system developed along with joints and faults traversing the rocks facilitate groundwater circulation and hold moderate quantity of water. The quality of groundwater is governed by the mineralogical composition of these rocks. Exposed in the eastern portion are the volcanic rocks intercalated with minor sediments representing the schist belts. The joint pattern in the metavolcanic rocks control movement of water and they normally yield better quality water. Groundwater in general occurs in the water table conditions in the weathered and decomposed mantle and also under semi-confined conditions in the deeper fractures.

5. Groundwater quality characterization

To understand and gather information on groundwater quality, 4509 samples collected from 657 villages/habitations in Koppal district have been analysed by RDED.

The water samples have been analysed for only 14 parameters such as Turbidity, Colour, Conductivity, Hydrogen ion concentration (pH), Total Dissolved Salts (TDS), Total Hardness (TH), Calcium Hardness (CalH), Chloride (Cl), Sulphate (SO_4), Fluoride (F), Nitrate (NO_3), Alkalinity (Alk), Iron (Fe) and Bacteria. The data is presented in the Table.

5.1 Physical Characters

Turbidity

In the district, 624 samples show higher turbidity and it ranges between 11-540 JTU. The samples showing higher turbidity are from: Koppal (245 out of 1030 samples), Yelburga (208 out of 1022 samples), Kushtagi (154 out of 1136 samples) and Ganganati (17 out of 1321 samples). The water with highest turbidity is a pond water sample from Tondihal village (540 JTU) in Yelburga taluk.

Colour

In the total analyses, 179 samples covering 113 villages / habitations show colour intensity more than desired in the range of 26-333 HU. Highest intensity range of 26-333 HU observed in Yelburga (96 samples) followed by Koppal 26-264 HU (64 samples), Kushtagi 26-103 HU (17 samples) and Gangavati 100 HU (2 samples). Highest colour intensity (333 HU) is a pond water sample reported from Sompura village in Yelburga taluk and is probably because of the dense suspended mater in the water.

Electrical Conductivity (EC)

In Koppal district, the EC value ranges from 100 - 18360 mmhos / cm. The range of EC values noted in the taluks are Koppal 100 - 10410 mmhos/cm, Kushtagi 120 -13340 mmhos/cm, Gangavati 250 - 18360 mmhos / cm and Yelburga 169 to 9090 mmhos/cm. The maximum value recorded is from Eliganoor village (18360 mmhos/cm) in Gangavati taluk.

Hydrogen ion concentration (pH)

About 480 samples covering 203 villages have shown the variation in pH values from acidic to basic in the range of 0.25 to 9.36 with least (0.25) reported from Rangapur village in Kushtagi taluk and highest (9.36) being reported from Aral village in Gangavati taluk. The ranges in pH values in the taluks are: Gangavati (8.51 - 9.36, 380 samples), Koppal (5.86 - 9.15, 33 samples), Kushtagi (0.25 - 8.72, 23 samples) and Yelburga (8.6 - 9, 44 samples).

5.2 Chemical Characters

Total Dissolved Salts (TDS)

There are 438 samples covering 153 villages / habitations have higher content of TDS Ranging from 2002 to 8400 ppm. The ranges of abnormal TDS content in different taluks are: Gangavati (2053 - 6820 ppm, 72 samples), Koppal (2002 - 6471 ppm, 155 samples), Kushtagi (2004 - 8400 ppm, 82 samples) and Yelburga (2002 - 5488 ppm, 129 samples). The highest value of 8400 ppm is reported from Sirugrempi village in Kushtagi taluk.

Total Hardness (TH)

Nearly 905 samples spread across 275 villages have recorded TH value beyond the permissible limit in the range of 601 to 4193 ppm. The range of TH values above the permissible limit in other taluks are: Gangavati (602 - 3478 ppm, 218 samples), Koppal (601 - 4040 ppm, 294 samples), Kushtagi (604 - 4193 ppm, 158 samples) and Yelburga (601 - 2790 ppm, 235 samples). The highest TH content (4193-ppm) is reported from Banahatti village of Kushtagi taluk.

Calcium Hardness (CalH)

There are 494 samples spreading across 172 villages having CalH above the standard limit in the range from 201 to 2024 ppm. The abnormal samples are from Koppal (187 samples with CalH 201 to 2024 ppm), Yelburga (125 samples with CalH 202 to 762 ppm), Gangavati (93 samples with CalH 205 to 779 ppm) and Kushtagi (89 samples with CalH 201 to 1087 ppm).

Chloride (Cl)

Only 100 samples have shown Cl content in the range of 1002 - 2464 ppm. Four samples from Yadgir taluk have shown abnormality followed by 3 samples from Koppal (64 samples with Cl 1004 - 2184 ppm), Yelburga (18 samples with Cl 1002 - 1890 ppm), Kushtagi (10 samples with Cl 1078 - 2464 ppm) and Gangavati (8 samples with Cl 1011 - 2144 ppm). The highest value 2464 ppm is reported from Banahatti village of Kushtagi taluk.

Sulphate (SO_4)

In the entire district, 181 samples covering 77 villages / habitations have (SO_4) content more than the permissible limit ranging from 401 to 1820 ppm. Majority of these abnormal samples are from: Kushtagi (88 samples covering 38 villages), Gangavati (65 samples covering 23 villages), Yelburga (25 samples covering 14 villages) and Koppal (3 samples covering 2 villages). The maximum (1820 ppm) is reported from Takkalki village in Kushtagi taluk.

Fluoride (F)

The analytical data has revealed that 1778 samples covering 477 villages/habitations have shown fluoride content in the range of 1.51 to 16.6 ppm. The abnormal variation reported from different taluks are: 1.51 to 4.32 ppm in Gangavati (337 out of 1321 samples), 1.52 to 16.6 ppm in Koppal (498 out of 1030 samples), 1.51 to 11.25 ppm in Kushtagi (615 out of 1136 samples) and 1.51 to 6.6 ppm in Yelburga (328 out of 1022 samples). The highest concentration of fluoride (16.6 ppm) is reported from Munirabad village of Koppal taluk.

Nitrate (NO_3)

No abnormal nitrate content is reported in the entire district.

Alkalinity (Alk)

In all 381 samples analysed have Alkalinity in excess of the permissible limit ranging between 602 and 4645 ppm. The ranges of abnormality recorded in the different taluks are: Gangavati 655 - 687 ppm (2 samples), Koppal 604 - 4645 ppm (119 samples), Kushtagi 602 - 1886 ppm (256 samples) and Yelburga 620 - 680 ppm (4 samples). The highest Alkalinity is reported from Chikabaganal (4645 ppm) village of Koppal taluk.

Iron (Fe)

Only 13 samples from 13 villages / habitations have analysed iron content in the range of 1.1 to 4.6 ppm.. These samples are from Koppal (8 samples), Kushtagi (4 samples) and Yelburga (1 sample). The maximum iron content (4.6 ppm) is reported from Mudalapura village in Koppal taluk.

Bacteria (*E.coli*)

In the district, 1749 samples covering 574 villages / habitations have shown the presence of organisms *E.coli* in drinking water. The Bacterial count generally varies between 1-26 No.s/100 ml. Majority of these abnormal samples are from Yelburga (477 samples), Kushtagi (445 samples), Koppal (432 samples) and Gangavati (395 samples).

5.3 Spatial Variation

Bacteria (*E.coli*)

A perusal of the bacterial incidence map indicates that, the bacterial incidence is a common phenomenon in the sampled villages. The bacterial incidence can be point specific and may be due to local contamination.

Fluoride (F)

The isoconcentration map (Fig.20A) reveals that, only few isolated patches having higher fluoride content are seen in the northern portion comprising Kushtagi taluk, southern portion encompassing Koppal taluk, and central portion consisting of Koppal and Yelburga taluks.

Total Dissolved Salts (TDS)

The isoconcentration map (Fig.20B) shows that, the western portion of the district covering western half of Yelburga and Koppal taluks and few isolated patches in the eastern and northern part covering Gangavati and Kushtagi taluks respectively have recorded abnormal TDS content.

Total Hardness (TH)

Total hardness isoconcentration map (Fig.20C) indicates that, southern and southwestern part of the district covering western half of Yelburga and Koppal taluks, in the east covering eastern half of Gangavati taluk and isolated patches in the central and northern part covering northern Koppal, eastern Yelburga and central-north Kushtagi taluks show abnormal TH content.

Sulpahte (SO_4)

Isoconcentration map (Fig.20D) has shown confinement of higher concentrations of sulphate to the northern portion comprising Kushtagi taluk and eastern part comprising Gangavati taluk only.

6. Conclusion

The water quality data of Koppal district has reflected the presence of excess Turbidity, Total Hardness, Fluoride and the Bacterial content. Hardness can be reduced by some conventional methods and turbidity can be reduced by filtration. In case of Fluoride, utmost care has to be taken, since many samples have analyzed excess of Fluoride. Though a little amount of Fluoride is essential for bone development in the infants, excess consumption of Fluoride will induce physical disabilities and Dental Fluorosis. Therefore, it is very essential to treat the water to the desirable standard before it is supplied to the drinking purpose. The most important component, which is much more harmful, is the presence of Bacteria viz., *E. coli* in drinking water. The consumption of such water may cause the diseases such as Malaria, Diorrhoea etc. Probably, the organisms might have been introduced into the groundwater regime by anthropogenic activities. This clearly indicates non-hygienic / poor sanitation condition prevailing at village levels. To overcome this both the user and the administrator must be trained properly and awareness has to be created regarding hygienic aspects.

Table: Comprehensive analysis of water quality data of Koppal District

SL. NO.	Name of the taluks	Number of villages/ habitations	Number of sampled villages	Number of samples analysed	Water quality scenario	Bact (c/100 ml) -0	Tur (10) JTU	Color (25) HU	Cond – mmhos /cm	pH (6.5-8.5)	TDS (2000) ppm	TH (600) ppm	CalH (200) ppm	Cl (1000) ppm	SO_4 (400) ppm	F (1.5) ppm	NO_3 (100) ppm	Alk (600) ppm	Fe (1) ppm
1	Gangavati	198	193	1321	No. of samples beyond permissible limit	395	17	2	-	380	72	218	93	8	65	337	-	2	-
					No. of villages affected	134	15	1	-	134	31	64	32	6	23	133	-	1	-
					Range	1-11	12-112	100	250-18360	8.51-9.36	2053-6820	602-3478	205-779	1011-2144	401-1578	1.51-4.32	-	655-687	-
2	Koppal	152	148	1030	No. of samples beyond permissible limit	432	245	64	-	33	155	294	187	64	3	498	-	119	8
					No. of villages affected	140	105	41	-	17	45	80	57	19	2	109	-	42	8
					Range	1-26	12-56	26-264	100-10410	5.86-9.15	2002-6471	601-4040	201-2024	1004-2184	426-536	1.52-16.6	-	604-4645	1.1-4.6
3	Kushtagi	176	172	1136	No. of samples beyond permissible limit	445	154	17	-	23	82	158	89	10	88	615	-	256	4
					No. of villages affected	157	78	14	-	17	35	62	37	6	38	140	-	87	4
					Range	1-26	11-188	26-103	120-13340	0.25-8.72	2004-8400	604-4193	201-1087	1078-2464	402-1820	1.51-11.25	-	602-1886	1.3-2.2
4	Yelburga	149	144	1022	No. of samples beyond permissible limit	477	208	96	-	44	129	235	125	18	25	328	-	4	1
					No. of villages affected	143	98	57	-	35	42	69	46	8	14	95	-	3	1
					Range	1-20	11-540	26-333	169-9090	8.6-9	2002-5488	601-2790	202-762	1002-1890	408-1440	1.51-6.6	-	620-680	2.2
	Total	675	657	4509	No. of samples beyond permissible limit	1749	624	179	0	480	438	905	494	100	181	1778	0	381	13
					No. of villages affected	574	296	113	0	203	153	275	172	39	77	477	0	133	13
					Range	1-26	11-540	26-333	100-18360	0.25-9.36	2002-8400	601-4193	201-2024	1002-2464	401-1820	1.51-16.6	0	602-4645	1.1-4.6

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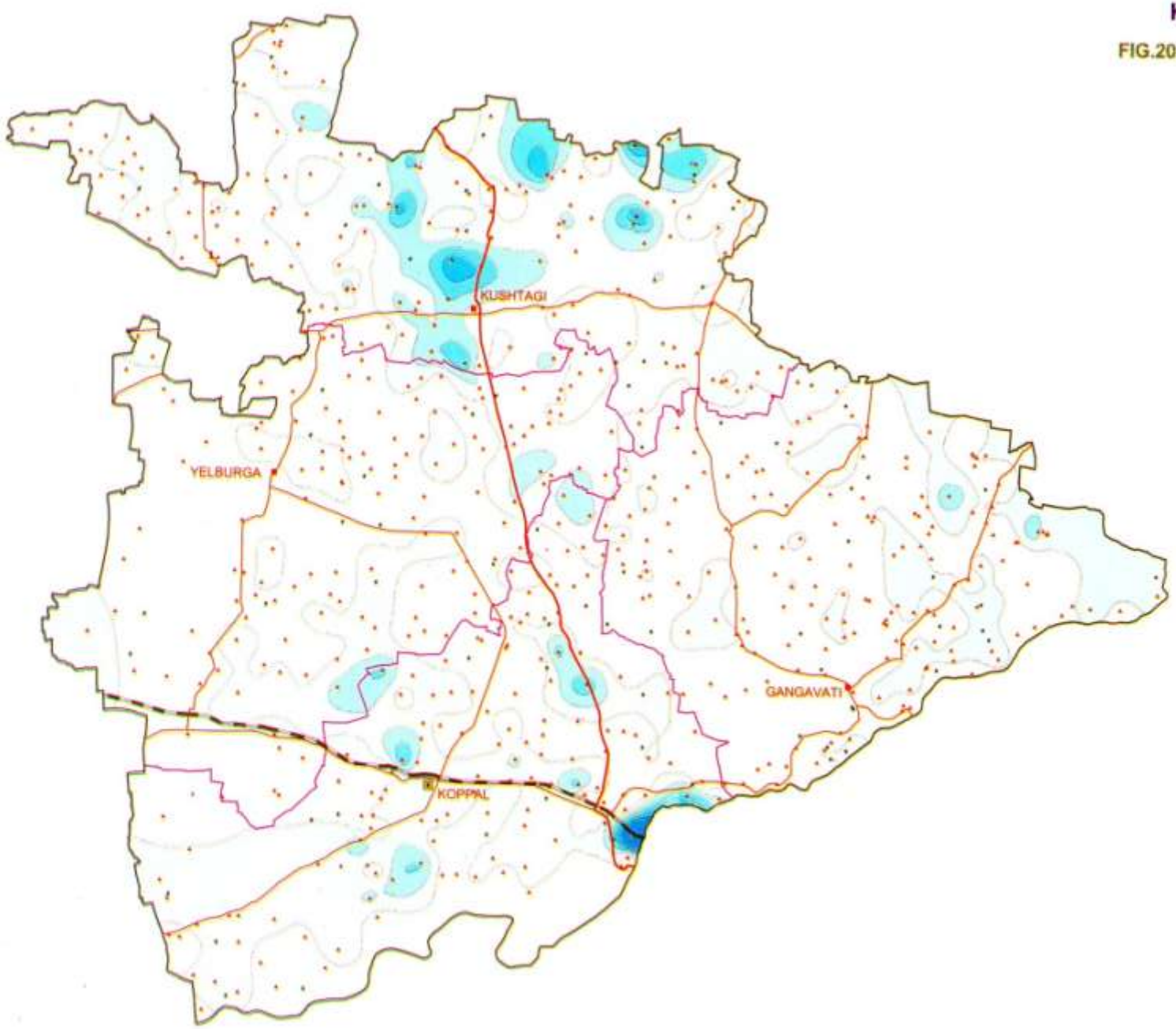
FIG.20A : FLUORIDE VARIATION



N

Scale

10 0 10 Kms

LEGEND

- Village Location
- Village where samples collected / Analysed
- Taluk Head Quarter
- District Head Quarter
- National Highway
- Major Road
- Railway Line

Fluoride in PPM
(Tolerance limit : 1.5ppm)

- < 1.5
- 1.5 - 3.0
- 3.0 - 4.5
- 4.5 - 6.0
- 6.0 - 7.5
- 7.5 - 9.0
- > 9.0

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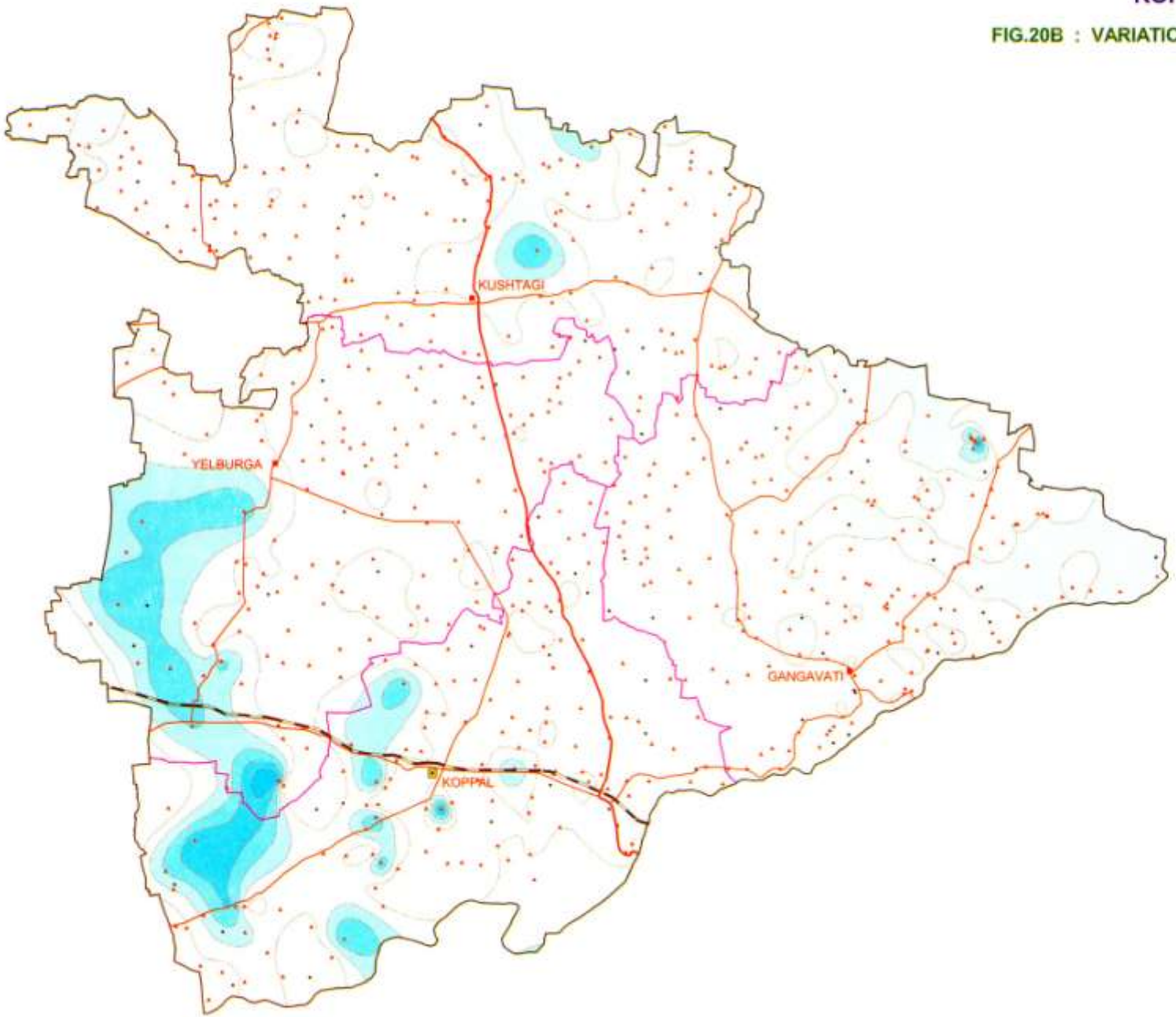
FIG.20B : VARIATION OF TOTAL DISSOLVED SALTS (TDS)



N

Scale

10 0 10 Kms

LEGEND

- Village Location
- Village where samples collected / Analysed
- Taluk Head Quarter
- District Head Quarter

TDS range in PPM
(Tolerance limit : 2000ppm)

- < 1000
- 1000 - 2000
- 2000 - 3000
- 3000 - 4000
- 4000 - 5000
- > 5000

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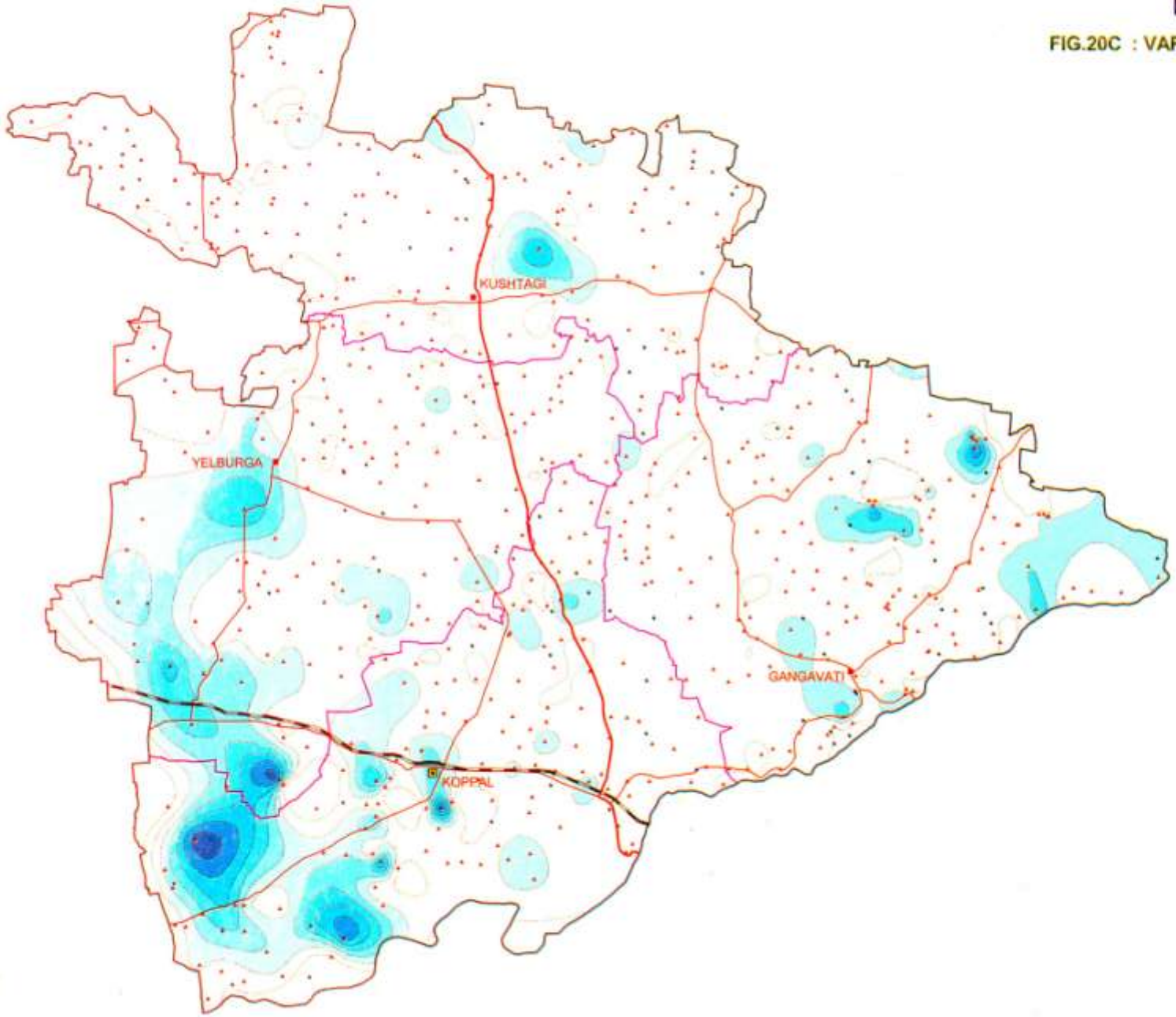
FIG.20C : VARIATION OF TOTAL HARDNESS (TH)



N

Scale

10 0 10 Kms

LEGEND

- Village Location
- Village where samples collected / Analysed
- Taluk Head Quarter
- District Head Quarter
- National Highway
- Major Road
- Railway Line

TH range in PPM
(Tolerance limit : 600ppm)

- < 200
- 200 - 600
- 600 - 1000
- 1000 - 1400
- 1400 - 1800
- 1800 - 2200
- 2200 - 2600
- > 2600

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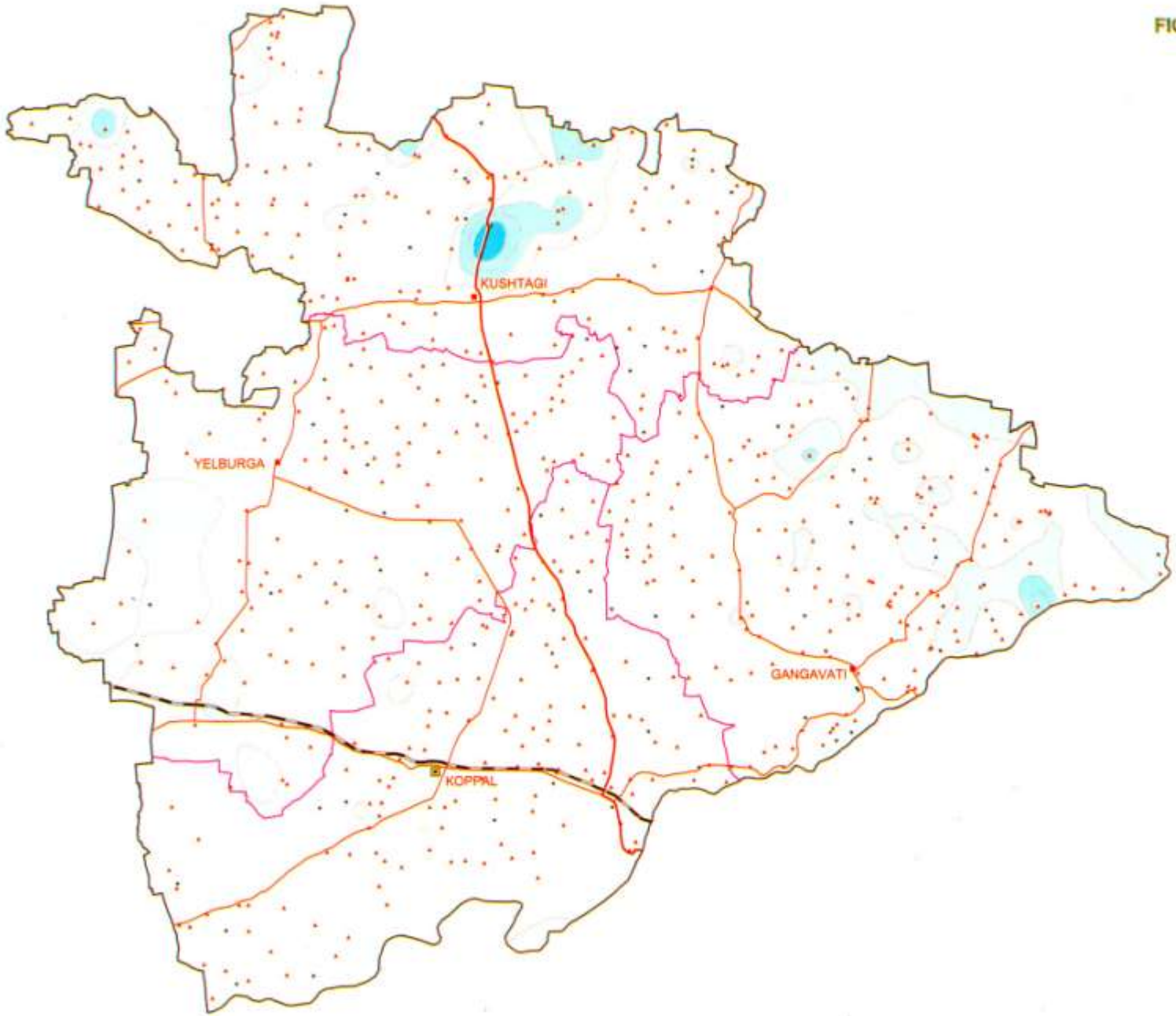
FIG.20D : SULPHATE VARIATION



N

Scale

10 0 10 Kms

LEGEND

- Village Location
- Village where samples collected / Analysed
- Taluk Head Quarter
- District Head Quarter
- National Highway
- Major Road
- Railway Line

SO_4 range in PPM
(Tolerance limit : 400ppm)

- < 200
- 200 - 400
- 400 - 600
- 600 - 800
- > 800