A FLUORIDE ZONATION MAP OF THE KARBIANGLONG DISTRICT, ASSAM, INDIA

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SUMMARY: The Assam region has been recognized only recently as one of the endemic fluorosis areas in India. Surveys indicate that one-seventh of the 700,000 people in the Karbianglong district of Assam have dental and/or skeletal fluorosis. For this reason, the high concentrations of fluoride (F) in the water resources in various areas of the district are of great concern. In this report we have utilized water F analyses of separate individual areas by subdividing the region into three zones (<0.10, 1.0-1.5, and >1.5 mg F/L) having different potentials for their vulnerability in relation to hazardous effects of F with possible precision and accuracy. These zonation plots should contribute significantly toward planning and developing an improved quality of life for the area and its people.

Keywords: Assam, India; Endemic fluorosis; Fluoride water; Karbianglong district; Zonation mapping.

INTRODUCTION

Endemic fluorosis is widely prevalent in India and in many countries around the world. Moreover, it is a major public health problem in some 25 countries in Asia and Africa. According to Government estimates, approximately 66 million people in India are at risk of fluorosis (which is more than 5 per cent of the total population).[1]

Among the 700,000 individuals living in the Karbianglong district of Assam, India, with an area of 10,526 km^2, one-seventh of them are afflicted with dental and/or skeletal fluorosis, which can lead to debilitating paralysis. Dental fluorosis is widely prevalent and is a clear sign early childhood overdose of fluoride (F). Worldwide, statistical evidence indicates that F poisoning is more widespread than arsenic poisoning. The severity of endemic fluorosis is such that it has already become a kind of public health disaster for Assam.[2] Thus India is facing another public health problem besides arsenic, which is present in West Bengal. To illustrate the extent of the F problem in Karbianglong, a recent survey revealed that 33% of the population of the district are afflicted with hydrofluorosis.[3] Out of 2063 people surveyed in eight villages, 646 (31.3%) were found to have dental fluorosis, and 36 (1.74%) were diagnosed with skeletal fluorosis. Other than water from hand-dug tube wells, the existing public water supply system also inadvertently distributes F-contaminated water to many of the villages.

BACKGROUND

The Karbianglong district, Assam, India, with high esthetic value and scenic beauty, has experienced a growing concern because of its recent association with F

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toxicity in the form of endemic dental and skeletal fluorosis.[2] This has attributed a significant societal concern to undertake a site-specific zonation study aimed at classifying areas in term of their potential for becoming sites of endemic fluorosis.

Microzonation is a research tool that helps to identify separate individual areas of a region in terms of their vulnerability to a specific concern with accurate, precise, and upgraded information. The present work involves an effort to classify areas of the Karbianglong district of Assam by subdividing the region into zones according to their water F levels with different potentials for hazardous effects of F. We believe that such an approach will contribute significantly to assist in water management practices for the people of the area.

MATERIALS AND METHODS

In the present first-time approach, data from 565 water analyses for F were collected for the period 2005–2008 by combining available resources from the Public Health Engineering Department of the Government of Assam. The information thus obtained was checked, evaluated, and used in a Geographical Information System (GIS) environment procedure to prepare a F zonation map of the Karbianglong district of Assam. As seen in the Figure, the area involved was divided into three zones with F concentrations ranging from <1.0 mg F/L, 1.0 to 1.5 mg F/L, and >1.5 mg F/L as shown by three different shadings. The level of 1.5 mg F/L is the highest tolerance limit set by the World Health Organization, but in India, because of food habits and the nutrient status of the people, the maximum is set at 1.0 mg F/L.

RESULTS AND DISCUSSION

From our study it is clear that the Karbianglong district is not evenly affected by the F content in the water system. Areas having more than 1.5 mg F/L need specific attention to investigate ways to improve human health and societal implications in them. Areas around Tumpreng, Taradubi, Samatero, Jamunajoipong, Parakhowa, Ramsapathar, Kheroni, and Doboka have water with more than 1.5 mg F/L. Areas around Dongkamonkam, Dokmoka, Lunglit, and Phuloni are within the range of 1.0 to 1.5 mg F/L. Areas around Bokajan, Chilonijan, Mohangaon, and Hangmalai have F concentration ranges below 1.0 mg/L. The information available from this study will undoubtedly help to mitigate adverse health affects of F in these areas and to evaluate the effectiveness of public health policy decisions and management prior to their implementation.

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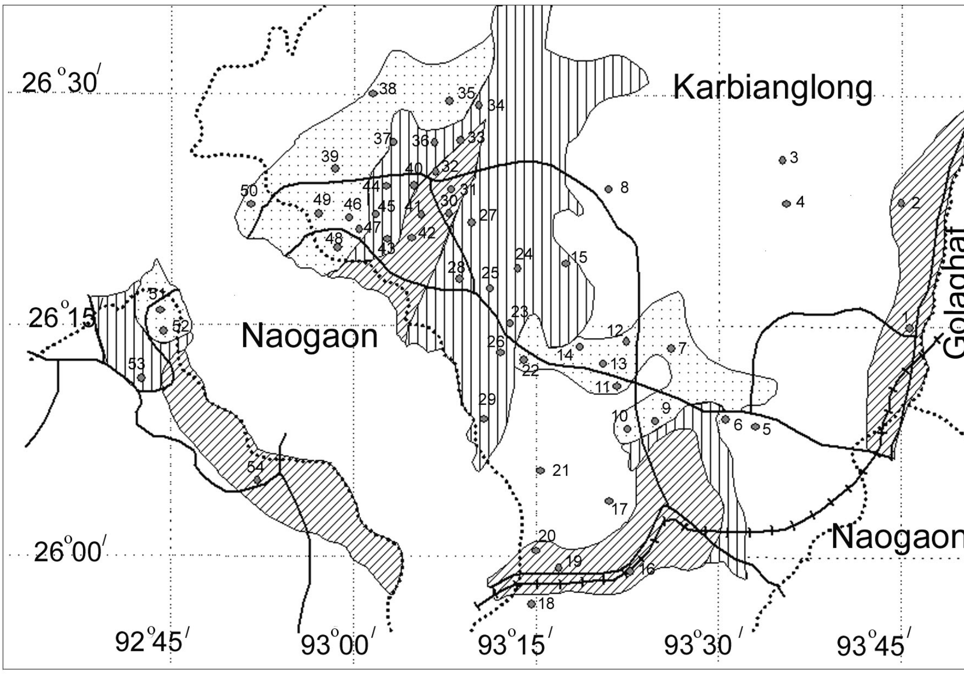

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District Boundary
Road
Rail Line

Fluoride Concentration

Fluoride <1.0 mg F/L
Fluoride 1.0 to 1.5 mg F/L
Fluoride >1.5 mg F/L

Places

1.Bokajan, 2.Chilanijan, 3. Maikang Gaon, 4. Lanka, 5. Dilai, 6. Amlokhi, 7.Chowkidarsogaon, 8. Longkamgaon, 9. Rongkanthir, 10. Kheroni, 11. Mahendijwa, 12. Lungnit, 13.Ramsapathar, 14. Tissomgaon, 15. Pattadisha, 16. Nailalong, 17. Kethu, 18. Kalidisha, 19. Borlangher, 20. Mohangaon, 21. Poklanggaon, 22. Dishabai, 23. Rongnagar, 24. Aragaon(i), 25.Aragaon (ii), 26.Bokulia, 27. Center Bazar, 28. Tetaliguri, 29. Ponglongpot, 30. Phulani, 31. Tomgpong, 32. Langhin, 33. Phongbrick, 34. Rongita, 35. Jashigmi, 36. Samatero, 37. Dentaghat, 38. Samalangso, 39. Parakhuwa, 40. Arapukhuri, 41. Kajasera, 42. Eradigholpani, 43. Lamnit, 44. Dokmoka, 45. Ampukhuri, 46. Sonapur, 47. Okrang (i), 48. Jamunajoipang, 49. Okrang (ii), 50. Doboka, 51. Tumpreng, 52. Taradubi, 53. Dongkamokam, 54. Hangmabai

Figure. Fluoride zonation map of the Karbianglong district, Assam, India.

REFERENCES

1 Reddy DR. Neurology of endemic skeletal fluorosis. Neurol India 2009;57:7-12.
2 Kotoky P, Barooah PK, Baruah MK, Goswami A, Borah GC, Gogoi HM, et al. Fluoride and endemic fluorosis in the Karbianglong district, Assam, India. Fluoride 2008;41:72-5.
3 Chakravarti D, Chanda CR, Samanta G, Chowdhury UK, Mukherjee SC, Paul AB. Fluorosis in Assam, India. Curr Sci 2000;78:1421-3.