

# Environmental Geochemistry in the Tropics (Fluoride Toxicity and Human Health): A Case report from India

K.L. Narasimha Rao<sup>1</sup>, S.V. L Rao<sup>1</sup> and Padma Bharathi Devi, Myneni<sup>2</sup>

<sup>1</sup> Dept. of Geology, S.V. University, Tirupati, 517 502, A.P., India

<sup>2</sup> Dept. of Periodontology, School of Dentistry, OH&SU, Portland, OR., USA

<sup>1</sup> [Prof.klnrao@gmail.com](mailto:Prof.klnrao@gmail.com)

<sup>2</sup> [Bmyneni@hotmail.com](mailto:Bmyneni@hotmail.com)

## Introduction

Fluoride in very limited quantities is desirable for healthy growth of bones and teeth and prevents dental caries, but excess quantities cause fluorosis. Incidence of fluorosis has been reported from several parts of the world including USA, China, West Indies, Spain, Poland, Mexico, India and some North African and South American countries. It is a now a known fact that fluorosis spreads among 67 million people in the entire arid and semi-arid tracts of India. Although several sources for fluorine have been mentioned, only fluoride content in ground waters has been studied in the present investigation. It has been found that the levels of fluoride content is varying from 0-16.2 mg/l. Only a few samples in Kallamudi and Tarimala villages, Anantapur district (study area), South India are found to contain the extreme values nearing 10.0 mg/l or even more. The reason for these extreme values may be due to the direct contact of waters with fluoride minerals such as fluorospar, fluorapatite, amphibolite and micas.

## Methods

In view of greater importance of fluoride toxicity and its effects, water samples from 50 wells and bore wells were collected and analyzed for fluoride content. Methods of collection of water samples as suggested by Rainwater and Thatcher (1960) were followed. A Unicam SP 500 Spectro-Photometer was used for determination of fluoride content adopting the Zirconium-Alizarin Method.

Fluorosis, an endemic disorder, caused by excess fluoride in water and develops due to certain faulty water management practices. If fluoride content is between 1.5 mg/l and 2.5 mg/l, mild dental fluorosis or mottling may appear and is prevalent in children drinking high-fluoride water. Subsequently, such dental defects were reported from several parts of the world—USA, Europe, England and other countries. A more severe type of fluorosis called “Skeletal Fluorosis or Osteofluorosis” may develop, if the fluoride content of drinking water is in excess of 3.0 mg/l, among adults under Indian conditions, affecting bones and joints. Although several sources for fluoride have been mentioned, only fluoride content in groundwaters has been studied in the present investigation. It has been found that the levels of fluoride content are varying from 0-16.2 mg/l. The work of the National Institute of Nutrition at Hyderabad in 1977

revealed the spread of endemic 'Genu Valgum (knock-knee)', crippling lower limbs from childhood in association with fluorosis in most parts in India. Although preliminary work revealed that genu valgum is caused by drinking waters poor in calcium and rich in molybdenum, efforts should be taken to understand the exact cause and prevent its wide-spread occurrence in the fluorosis areas of India. The authors' work revealed that the fluorine content of rocks in India at most places is much less than that in most developed countries. Despite that the fluoride content of groundwater in India is much higher than in most developed countries. As a result, fluorosis caused by excess fluoride in water is wide-spread in India and dental caries caused by deficiency of fluoride in groundwater is wide-spread in most developed countries. The present investigation reports the distribution pattern of fluoride toxicity in waters of Anantapur District, A.P., and India. The severity of the problem is more acute as only 30% of the villages have the fluoride content in drinking waters within the permissible limit (1.5 mg/l) and 70% of the villages above the permissible limit (>1.5 mg/l). Attempts are made to ascertain the fluoride toxicity in waters of Anantapur District and several measures have been suggested for follow-up action.

## Conclusions

In conclusion, it is realized that fluoride upto 1.0 mg/l in drinking water is beneficial; anything in excess of 1.5 mg/l is associated with 'mottling of enamel of teeth; and concentrations in excess of 3.0 mg/l may lead to skeletal fluorosis. Mottling of the teeth is the initial manifestation of fluorosis in children, and skeletal fluorosis is the final manifestation in adults.

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