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Uranium series disequilibrium studies in Chenchu colony area, Guntur district, Andhra Pradesh, India

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HIGHLIGHTS

- Chenchu colony area of Guntur District, Andhra Pradesh of India is a part of Koppunuru uranium deposit with an established tonnage of 3000 tons. A disequlibrium study has been carried out in the Chenchu Colony area to know the presence of disequilibrium in uranium series between parent uranium and daughter Radium-226.
- In Chenchu colony area, Banganapalle Formation is hosting uranium mineralisation proximal to basement unconformity and mainly associated with a gritty quartzite/conglomerate unit. At places, uranium mineralisation partly transgresses below the unconformity contact in basement granites along the fracture planes. Besides, the basement granites in the vicinity show substantial reactivation as evidenced by the presence of basic dykes, profuse quartz veins and WNW-ESE trending fractures sub-parallel to the Kandlagunta fault.
- The ore grades of mineralized zones obtained based on total gamma ray logging results gives eU_3O_8 values of mineralized rocks which needs to be corrected due to disequlibrium in the Uranium series. For this study, 634 numbers of subsurface samples collected from 35 boreholes of the Chenchu colony area and Uranium and Ra(eU_3O_8) concentration estimated to find out the disequilibrium factor by using Beta Gamma Method and Gamma Ray Spectrometry respectively.

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ABSTRACT

An attempt is made to understand uranium series disequilibrium in unconformity proximal related uranium mineralisation in Chenchu colony area, Guntur district, Andhra Pradesh, India. The uranium mineralization in Chenchu colony is the western continuity of the Koppunuru uranium deposit and predominantly hosted by gritty quartzite/conglomerate, which occasionally transgresses to underlying basement granite/basic rock. Disequilibrium studies are based on borehole core samples (35 boreholes, No. of samples=634) broadly divided in two groups of cover rocks of Banganapalle formation (above unconformity) and basement granites (below unconformity). Linear regression coefficient between uranium and radium is 0.95, which reflects excellent correlation and significant enrichment of parent uranium. Disequilibrium studies have indicated predominant disequilibrium in favour of parent uranium (35%), which is probably due to the weathering process causing migration of some of the radionuclides while dissolution of minerals due to groundwater action might have also played a significant role. Further, escape of radon might have accentuated the disequilibrium factor resulting in an increase in the grade of the mineralization. This is well corroborated by the presence of fractures and faults in the study area providing channels for radon migration/escape.

1. Introduction

For the growth and development of any country, energy is the prime requirement and hence sustainable energy resources are essential. With the fast depletion of fossil fuel reserves and pollution related issues associated with thermal energy, attention is being given to green and high density energy sources such as nuclear energy. Uranium is one of the main nuclear fuels, which needs to be developed to sustain the growth of nuclear energy. In India, an extensive exploration programme is being carried out in different geological domains to establish new uranium resources and reserves. In most of the cases, disequilibrium in radioactive

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ore has presented a difficult problem for proper assessment of the resources. However, it is observed that the magnitude and frequency of radioactivity disequilibria is generally ignored leading to underestimation or overestimation of the deposit. In recent years the significance of disequilibrium studies is being given importance both in field and laboratory counting measurements to overcome uranium ore deposit evaluation related constraints.

In a radioactive series, equilibrium is attained when all the daughter products decay at the same rate that they are produced from the parent isotope (Hay et al., 1972). Thus, at equilibrium each of these daughter products would be present in a constant proportion to its parent isotope. The loss or gain of any important isotopes, by different geological and physicochemical processes, during the more recent part of the existence of a mineral, causes disequilibrium in the proportions of the parent isotope to its daughter products (Rosholt, 1958). The importance of these aspects is being evaluated for unconformity proximal and fracture controlled types of uranium mineralisation in Chenchu colony area, which falls in the Northern part of Cuddapah basin.

U-series disequilibrium study of subsurface core samples of Chenchu colony area has been done by using the beta gamma method and gamma ray spectrometry. The present paper deals with results of disequilibrium studies and its implication on uranium distribution pattern/mineralisation.

2. Geological setting

Uranium mineralization in the northern part of Cuddapah basin has been explored by the Atomic Minerals Directorate for Exploration and Research (AMD) over two decades and the established unconformity proximal uranium deposit in Srisailam and Palnad sub-basins (Sinha et al., 1995, 1996; Jeyagopal et al., 1996). Koppunuru uranium deposit is mainly hosted in cover rocks of Banganapalle formation (85%) and occasionally transgresses in to basement granites (15%) along well defined fractures across the unconformity contact (Verma et al., 2011).

Chenchu Colony area is located in the south-western marginal part of Palnad Sub-basin and is being explored for uranium mineralization to check the western continuity of the Koppunuru uranium deposit. Palnad sub basin exposes Kurnool Group of sediments which are deposited over basement granites, exposed along the up-thrown block of the WNW–ESE trending Kandlagunta fault and as inliers in the southern and western parts (Fig. 1). The basement rocks are mainly represented by medium to coarse grained pink and pinkish grey granites. These granites are highly sheared, fractured and traversed at places by dolerite dykes and quartz veins signifying basement reactivation.

Kurnool Group is represented by a thick column of sediments belonging to the quartzite-limestone-shale cycle. This group is classified into six formations viz., Banganapalle, Narji, Auk (Owk), Paniam, Koilkuntla and Nandyal formations (Nagaraja Rao et al., 1987). Among these, the first four formations are well developed

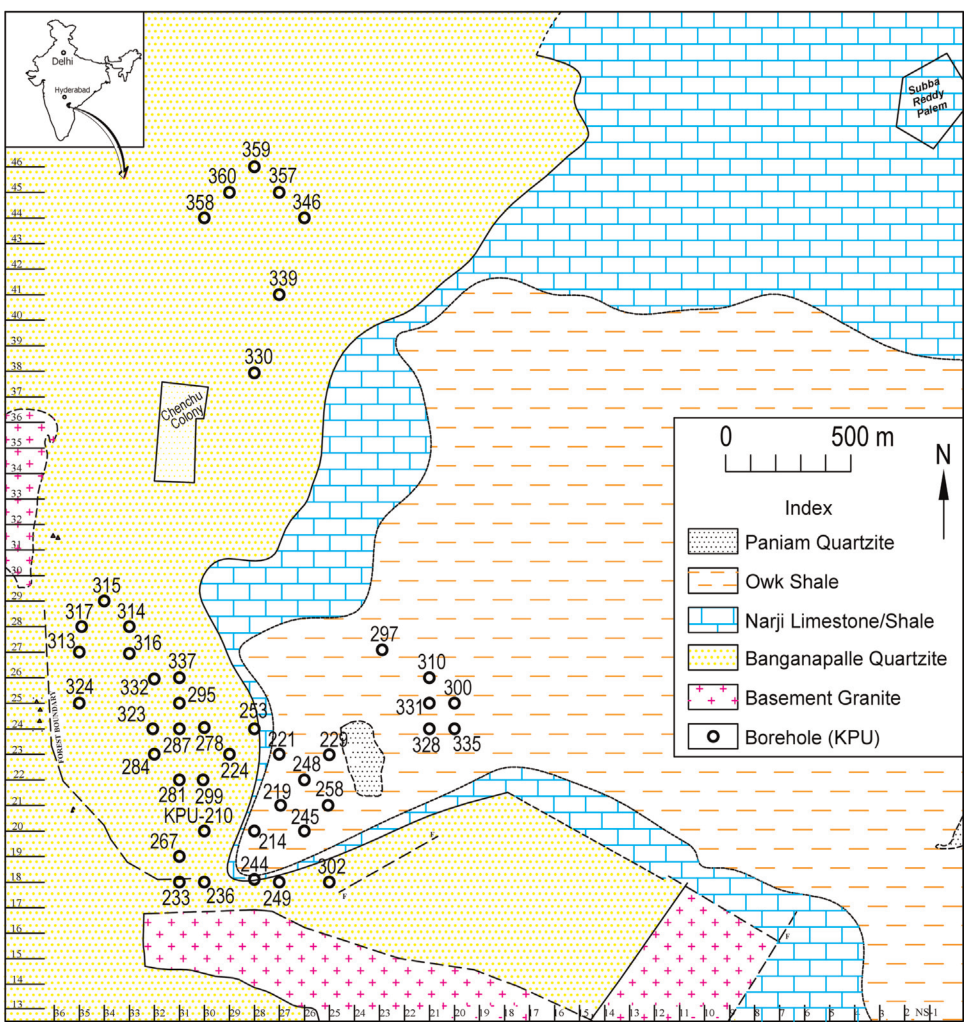

Fig. 1. Geological map of Chenchu colony area, Guntur district, Andhra Pradesh along with studied borehole locations.