

WAVELENGTH DISPERSIVE X-RAY FLUORESCENCE SPECTROMETRIC DETERMINATION OF URANIUM AND THORIUM IN GRANITIC ROCKS

S. Viswanathan, P.B. Maithani, and Yamuna Singh*

Atomic Minerals Directorate for Exploration and Research,

Department of Atomic Energy, Government of India, Begumpet, Hyderabad

E-mail: yamunasingh2002@yahoo.co.uk

Abstract

Granitic rocks are an important source of uranium and thorium. Vast granitic terrains in Peninsular and Extra-Peninsular India remain uncharacterized geochemically. Therefore, it is essential to delineate granitic rocks that are anomalously enriched in uranium and thorium.

The paper proposes a simple, accurate, precise, and rapid technique for determining uranium and thorium in granitic rocks by wavelength-dispersive x-ray fluorescence spectrometry (WDXRFS). The technique uses a sequential x-ray fluorescence spectrometer, 100 kV - 80 mA - 3 kW x-ray generator, rhodium x-ray tube, LiF 220 analyzing crystal, fine (150 μm) collimator, air path, scintillation detector, and short counting times. The analytical standards for determining uranium in granitic rocks consisted of a uranium-free granitic rock, spiked with spectrographically-pure uranium oxide, to give analytical standards with uranium concentrations ranging from 7.1 to 14508.4 ppm uranium. The international granitic rock standards, G-1, G-2, GSP-1, GA, GH, and GS-N, were used as analytical standards for determining thorium in granitic rocks.

The accuracy of the technique is excellent (within 1% for uranium and within 3% for thorium). The precision is also excellent (within 1% for uranium and within 2% for thorium). The lower limits of detection are 2 ppm for uranium and 4 ppm for thorium. The time taken for determining uranium and thorium in a batch of twentyfour samples of granitic rocks, for a replication of four analyses per sample, by one operator, using a manual wavelength-dispersive x-ray fluorescence spectrometer, is only twelve hours.

Keywords: X-ray fluorescence spectrometry. WDXRFS. Granitic rocks. Uranium. Thorium.

*Corresponding author