Abstract

Barium is an important trace-element in silicate–rocks, especially in granitic rocks. The Ba/Rb ratio can be used to determine if a granitic rock formed from a highly evolved melt or not. As the atomic number (Z) of barium is high (Z = 56), we have to use the characteristic radiations of barium from the x-ray L spectrum. The available analytical lines are BaLα, BaLβ1,3, and BaLγ1. BaLα is overlapped by TiKα. BaLβ1,3 is liable to interference from CeLα. BaLγ1 is weak. The availability of 100 kV x-ray generators makes it possible to use BaKα to determine barium in silicate–rocks.

The paper proposes a simple, accurate, precise, rapid, and non-destructive technique to determine barium in silicate-rocks by wavelength-dispersive x-ray fluorescence spectrometry (WDXRFS) using BaKα and five different x-ray excitation sources (gold, tungsten, rhodium, silver, and molybdenum) and compares the results obtained with respect to accuracy, precision, and lower limits of detection. The technique uses a sequential x-ray fluorescence spectrometer, 100 kV–80 mA–3 kW x-ray generator, LiF 220 analyzing crystal, fine (150 µm) collimator, air path, scintillation counter, and short counting times. The international rock standards, BCR-1, AGV-1, W-1, G-1, G-2, GSP-1, GA, and GS-N, were used as analytical standards.

The accuracy and precision of the technique are excellent (within 1%). The lower limits of detection for the five different x-ray excitation sources are: 23 ppm (gold); 23 ppm (tungsten); 30 ppm (rhodium); 35 ppm (silver); and 88 ppm (molybdenum). The time taken to determine barium in a batch of twenty-four samples of silicate-rocks, for a replication of four analyses per sample, by one operator, using a manual wavelength-dispersive x-ray fluorescence spectrometer, is only six hours.

Keywords: X-ray fluorescence spectrometry, WDXRFS, Barium, BaKα, Silicate-rocks.