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THE ESTIMATION OF VOLCANIC GLASS CONTENT IN NATURAL MATERIALS USING PXRD AND FTIR TECHNIQUES

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One of the basic constituents of the industrial rocks is the volcanic glass. Therefore, the calculation of its percentage in a sample is important in Economic Geology. Volcanic glass is usually observed in PXRD as a broad background hump starting at approximately 10° 2θ. Five standard sample mixtures were used with the following weight percent ratios of amorphous and crystalline phases: 100-0 %, 75-25 %, 50-50 %, 25-75 % and 0-100 %, respectively. The 100 % volcanic glass used as standard material, is obsidian from the island of Santorini (KANTIRANIS et al., 1999). Crystalline materials chosen for the preparation of the sample mixtures were quartz, calcite, muscovite, montmorillonite and heulandite. The five constituents of the crystalline phases in the samples were present in equal quantities. The conditions for the preparation and analysis of the samples were identical.

PXRD analysis was performed on randomly oriented samples, which were scanned over the interval 3-63° 2θ, using a Philips PW1710 diffractometer, Ni-filtered CuK_α radiation and PCAPD v.3.6 (1994) software. The PXRD patterns were studied by two methods. For the first method, the area of the broad background hump of each sample was compared with the corresponding area of the broad background hump of the 100 % volcanic glass. For the second method, which calculates the crystallinity of the sample, each individual peak of the PXRD patterns of the samples was analyzed using exponential shape functions (pseudo-Voigt function), including those for amorphous material (STERGIOU, 1995). The results of the two methods were used providing that the variance of values of volcanic glass were ±3 %.

FTIR measurements were performed using the KBr pellet technique. The transmission spectra were recorded using a Bruker IFS113v spectrometer under vacuum in the MIR region, with a resolution of 2 cm^{-1} The presence and characteristics of each band is due to vibrations related to sites with corresponding symmetry. Any structural change taking place influences characteristic bands and this gives direct information on the crystallinity. The development of these bands through the increase of volcanic glass participation is used for the quantitative analysis of the studied samples.

The results indicate that the two techniques could constitute a reliable procedure for the accurate estimation of the amount of volcanic glass contained in a natural rock sample.

References

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