MAPPING MINERALS IN OBSIDIAN GLASSES BY USING MICRO-PIXE TECHNIQUE

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The subject of the current paper is to map minerals mainly in Carpathian obsidian glasses by nuclear microprobe based Particle Induced X-ray Emission (PIXE) method providing analytical data on them for the first time. The samples were basically collected in order to study the glassy material from archaeometrical and geochemical point of view (ELEKES *et al.*, 2000; RÓZSA *et al.*, 2000). Most of the analysed obsidian specimens containing different phenocrysts come from the Tokaj Mountains. These mountains (NE Hungary, Borsod-Abaúj-Zemplén County) form the southern part of the Tokaj–Prešov Tertiary volcanic range. Some samples from Armenia, Greece are also involved to make a comparison with the Carpathian specimens.

Although the routine analysis of mineral phases is usually carried out by electron microprobe (EPMA) technique, the applications of nuclear microprobes (NMP) with the use of well-established proton induced X-ray emission (PIXE) method have become more and more common and accepted during the last decade (RYAN, 1995). Concerning elemental analysis, NMPs have approximately similar resolution (1x1 m^2) as EPMAs but NMPs provide superior detection limits that can be especially advantageous when minor and trace elements are to be measured.

The following minerals are identified and analysed: pyrrhotite, chalcopyrite, pyrite, zircon, pyroxene, biotite, plagioclase feldspar, and anhydrite. Although our main goal is to report on the above minerals, on the basis of rock-forming silicate minerals, some petrologic processes are outlined, as well. Moreover, with the identification of accessory minerals (such as anhydrite, pyrrhotite, chalcopyrite, pyrite), some geological conclusions are also drawn.

On the basis of the study of phenocrysts observed in the obsidian glasses some petrologic conclusions can be drawn. Hf contents of zircon crystals in obsidian samples from two localities of the Tokaj Mts. (Sima in Hungary and Viničky in Slovakia) show definite differences. It seems that Ca-poor orthopyroxene crystal in the sample from Sima (Hungary) is in equilibrium, while Ca-rich pyroxene crystals of obsidians from Melos and Giali (Greece) may be in equilibrium with the residual glass. Therefore, it is possible that these crystals cannot be regarded as xenocrysts. However, Ca-rich plagioclase feldspars detected in samples from Viničky (Slovakia) and Melos (Greece) have probably been incorporated in the glass. Anhydrite-chalcopyrite and pyrrhotite-pyrite-chalcopyrite assemblages in obsidians from Aragats Mountain (Armenia) and Viničky (Slovakia) were formed by hydrothermal activity. However, it is questionable whether the solid obsidian rocks suffered the hydrothermal activity or these crystals were incorporated by the rhyolitic melts. It is also possible that sulphur was stored in a coexisting fluid phase; in this case these minerals could be regarded as primary ones.

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