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VOLCANIC EVOLUTION AND STRATIGRAPHY OF THE MIOCENE BÖRZSÖNY MOUNTAINS, HUNGARY: AN INTEGRATED STUDY

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Abstract: The Middle Miocene volcanic evolution of the Börzsöny Mountains, North Hungary, is presented, correlating new volcanological, petrological, geochemical, geophysical and paleontological data and establishing a detailed stratigraphy on the basis of additional K/Ar radiometric and paleomagnetic measurements. For the earliest volcanic activity, previous biostratigraphy showing an Early Badenian age has been confirmed and precisely defined by paleomagnetic investigations. The first-stage volcanic formations (16.5–16.0 Ma), deposited in a shallow marine environment, include resedimented, syn-eruptive, garnet-bearing dacitic volcaniclastics (originating mostly from small-scale ignimbrite eruptions) and coeval, garnet-bearing dacitic lava domes, sometimes with their volcaniclastic aprons. As the eruptions filled the marine basin, subaerial dacitic-andesitic volcaniclastics, comprising minor ignimbrites and different types of debris-flow deposits were also deposited. A part of the latter may have been related to the formation of two or three medium-sized calderas. The second stage (16.0–14.5 Ma) was characterized by andesitic lava dome activity terminated by a hydrothermal event. During the first half of this stage, a ca. 30° CCW rotation occurred. The third stage produced the most voluminous, moderately explosive, andesitic — basaltic andesitic High Börzsöny subaerial lava dome complex erupting up to the Badenian/Sarmatian boundary (ca. 13.7 Ma). Correlation of K/Ar geochronological and volcanological data shows that lava dome activity of the second and third stage may have been coeval with marine sedimentation in the southern Börzsöny.

Key words: Miocene calc-alkaline volcanism, Börzsöny Mountains, volcanology, geochemistry, paleomagnetism, K/Ar geochronology.

1. Introduction

In the past years, a renewed scientific interest has resulted in a number of publications on the geological history of the Miocene dacitic-andesitic volcanism of the Börzsöny Mountains, North Hungary. However, a synthesis of different scientific approaches to this very complex volcanic area has not been presented, in spite of contributions to the relationship between timing of volcanism and ore mineralization (Korpás & Lang 1993), volcanological aspects related to structure (Karátson 1995, 1997), stratigraphical problems (Korpás et al. 1998) and dividing volcanic formations on maps (Korpás & Csillag-Teplánszky 1999; Karátson et al. 1999a). In this paper, on the basis of an integrated research including field volcanology, paleomagnetic and radiometric measurements, petrology, geochemistry, gravimetry and paleontology, we summarize the volcanic evolution and stratigraphy of the Börzsöny Mountains. Although some open questions have remained, the complexity of our method may serve as an example for studying highly degraded volcanic mountains, like many in the Inner Carpathian calc-alkaline Volcanic Chain.

2. Geologic and geomorphic setting

The Börzsöny Mountains are among the westernmost and oldest members of the Carpathian Neogene to Pleistocene Volcanic Chain (Fig. 1). Xenoliths in the volcanics and partly borehole data show that the basement consists of carbonate rocks related to the Transdanubian Mountains to the S and crystalline schists of the Veporids to the N, separated by the Diósjenő line (Balla 1977). These rocks are overlain mostly by Oligocene and Lower to Middle Miocene sedimentary formations (predominantly clay, sandstone and gravel; e.g. Korpás et al. 1998). Underlying the subsequent Middle Miocene volcanics, these formations crop out mostly along the eastern margin of the Börzsöny Mountains. The volcanic rocks are also covered by Middle Miocene (Badenian) limestone and clay marl mainly along the western margin and in the southern part of the mountains (e.g. Báldi & Kókay 1970; Korpás et al. 1998).

From the geomorphic point of view (Fig. 2), the Börzsöny Mountains are characterized by the contrast of the northern and southern hilly terrain (400–600 m) and the central "High