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Late Miocene–Quaternary volcanism, tectonics and drainage system evolution in the East Carpathians, Romania

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Abstract

Middle Miocene (Sarmatian) convergence created the fold and thrust belt of the Eastern Carpathians of Romania, which subsequently experienced post-collisional crustal deformation combined with calc-alkaline and alkalic-basaltic volcanism in late Miocene–Quaternary time. This deformation led to the rise of the Călimani–Gurghiu–Harghita volcanic mountains and to the subsidence of the N–S-oriented intramontane Borsec/Bilbor–Gheorgheni–Ciuc and Braşov pull-apart basins, and the E-oriented monocline-related Făgăraş basin. The regional drainage network is the composite of:

(1) Older E-, SE- and S-flowing rivers, which cross the Carpathians, radiate towards the foreland and were probably established during the Middle Miocene (Sarmatian) collision event.
(2) A more recent drainage system related to the contemporaneous development of the volcanoes and intramontaneous basins, which generally drains westward into the Transylvanian Basin since late Miocene time and has been capturing the older river system.

The older river drainage system has also been modified by Late Pliocene–Quaternary folding, thrusting and monoclinal tilting along the Pericarpathian orogenic front and by reactivated transverse high angle basement faults, which cross the Eastern Carpathian foreland.

Keywords: Neotectonics; Volcanism; River drainage; East Carpathians; Foreland

1. Introduction

Active structures of evolving mountain chains are commonly expressed in the geomorphology of the fluvial drainage patterns. The geomorphology of the landscape reflects recent upper crustal deformations

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and displacements in the form of escarpments or block tilting near faults or folds and by discontinuities along planar or linear geomorphic markers (e.g. river terraces, erosional surfaces, river courses). In addition active volcanism connected to active tectonic structures also produces new geomorphological elements. The tectonic geomorphology strongly influences erosion, fluvial drainage pattern, drainage divides, flood plain morphology and the channel types (e.g. Ouchi, 1985; Keller and Pinter, 1996; Mial, 1996; Schumm et al., 2000; Burbank and Anderson, 2001), with climatic conditions controlling the intensity of the interplay between tectonic movements and geological structures (Bull, 1991). In this study we use geological, geomorphological and geophysical data to interpret the post-collisional Late Miocene–Quaternary neotectonics and kinematics of some key areas of the Eastern Carpathians of Romania. We also attempt to illustrate the impact of the structural evolution on the regional fluvial drainage system.

2. Geological setting

The Eastern Carpathians are part of the Alpine–Carpathian orogenic belt, which resulted from the convergence and collision of several microplates with the Eurasian plate during closure of the Tethys Ocean (Săndulescu, 1984; Csontos, 1995; Stampfli et al., 1998; Neugebauer et al., 2001). Several tectonic units have been accreted in the Carpathian area (Fig. 1). The Outer Carpathians or Moldavides on the east are part of the European margin (Săndulescu, 1988; see Fig. 1 for location). Their convergence and the

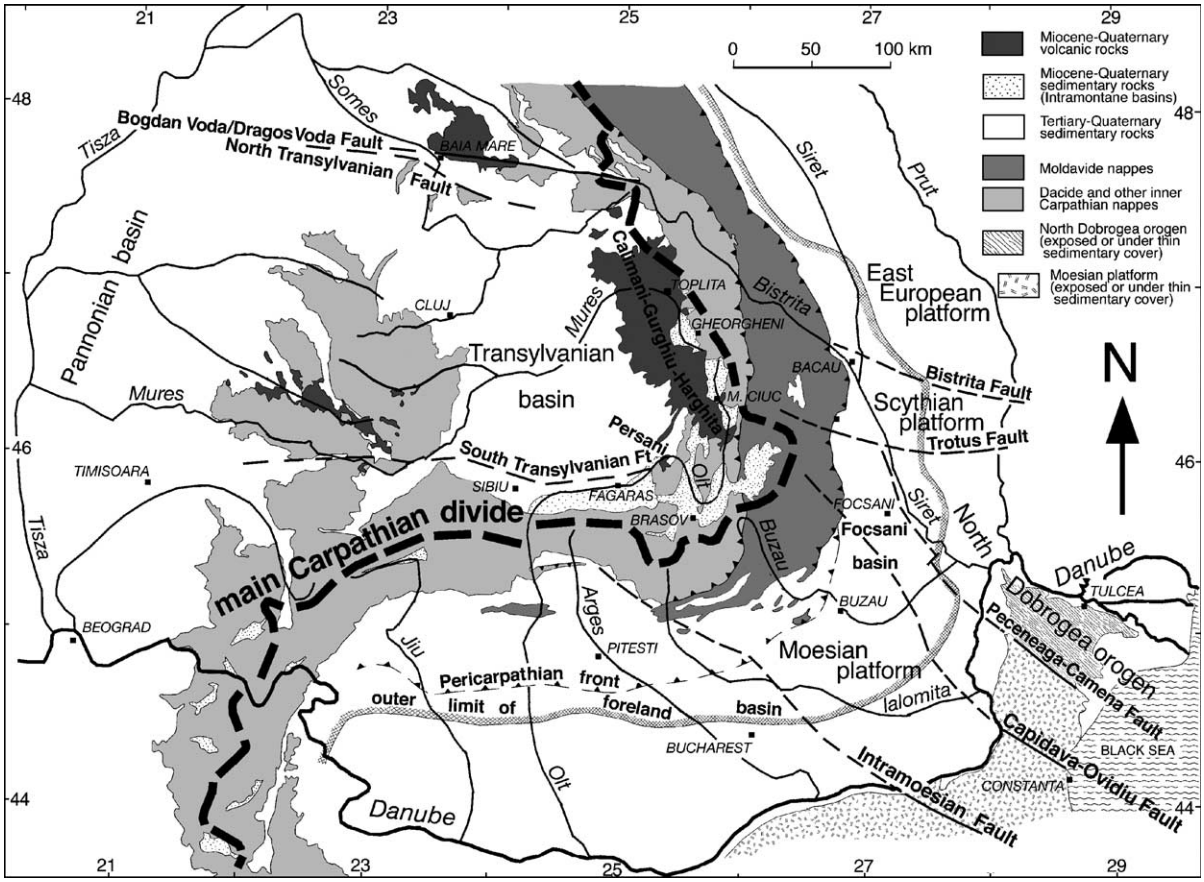

Fig. 1. Geological sketch map of the Eastern and Southern Carpathians of Romania and surrounding areas with major river courses and the first order drainage divide of the Carpathians (modified after Săndulescu et al., 1978; Săndulescu, 1984; Mațenco et al., 2003a).