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New paleomagnetic results for Tertiary magmatic rocks of Fruška Gora, Serbia

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Abstract. Fruška Gora Mountain is a large scale antiform located at the southeast part of the Pannonian Basin between the Danube and Sava Rivers. It is built of Paleozoic and Mesozoic rocks with Neogene sediments on all sides and at the flanks. The Paleozoic and Mesozoic rocks are largely metamorphosed (age of the metamorphism is early Cretaceous) and they are intruded by Eocene/Oligocene latites and rhyodacites and Badenian basaltic trachyandesite. On Fruška Gora two major structural units are observed, the northern and southern structural units which are divided by the Srem dislocation striking NNW–SSE.

The Tertiary magmatic rocks located on both sides of this dislocation were the subject of paleomagnetic analysis. Tectonically meaningful paleomagnetic directions are obtained from latites and rhyodacites, while basaltic trachyandesite has a secondary remanent magnetization. The obtained overall-mean paleomagnetic direction, after applying the correction for the general tilt of the Lower Miocene sediments, suggests a clockwise rotation (D = 210°, I = –45°, k = 21, α_{95} = 14°) of 30° with respect to the present North of blocks on both sides of the Srem dislocation. The fact that close to the end of Miocene–Early Pliocene Fruška Gora rotated in a counterclockwise direction for 40° with respect to the present North means that all of Fruška Gora rotated in a clockwise direction for 70° with the respect to the present North in a short time after the intrusion of Eocene/Oligocene magmatic rocks and before Middle Miocene.

Key words: Tertiary, magmatic rocks, Srem dislocation, paleomagnetic measurements, paleorotation, Fruška Gora Mt.

Апстракт. Фрушка гора је велика антиформа у јужном Панонском басену, између Дунава и Саве. Изграђена је од палеозојских и мезозојских стена док су јој стране прекривене неогеним седиментима. Већина палеозојских и мезозојских стена су метаморфисане (током ранокредног метаморфизма), а најзначајније постметаморфне стене су еоценско-олигоценски латити и риодацити, и баденски базалтни трахиандезити. У структурном плану на Фрушкој гори истиче се Сремска дислокација, пружања ССЗ–ЈЈИ, која Фрушку гору дели на северну и јужну структурну јединицу. Терцијарни магматити са обе стране ове дислокације били су предмет детаљних палеомагнетских испитивања. Тектонски значајни палеомагнетски правци утврђени су код латита и риодацита, док је код базалтних трахиандезита издвојена секундарна реманентна магнетизација. Добијени општи–средњи правац, након тектонске корекције генералним елементима пада доњомиценских седимената, указује на ротацију у смеру кретања казаљке на сату (D = 210°, I = –45°, k = 21, α_{95} = 14°) од 30° у односу на савремен правац севера блокова са обе стране Сремске дислокације. С обзиром да је крајем миоцена–раног плиоцена Фрушка гора ротирала 40° у смеру супротном од кретања казаљке на сату у односу на савремен положај севера, може се закључити да је цела Фрушка гора ротирала 70° у смеру кретања казаљке на сату у односу на савремен правац севера у веома кратком периоду, после интрузије еоценско/олигоценских магматита а пре средњег миоцена.

Кључне речи: Терцијар, магматити, сремска дислокација, палеомагнетска мерења, палеоротација, Фрушка гора.

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Introduction

Magmatic rocks of Paleogene to Early Miocene have a wide spatial distribution in the Pannonian Basin. These rocks are mostly covered by Neogene sediments, very rarely exposed on the surface. They built up a relatively huge zone which strikes parallel to major tectonic lines i.e. along the Balaton (BF), Mid-Hungarian (MHF), Sava (SF) and Drava (DF) fault (see KOVÁCS *et al*. 2007, Fig. 1). The Neogene sedimentary cover was deposited during back-arc collapse associated with the subduction and roll-back recorded in the external Carpathians (KOVÁCS *et al*. 2007).

Previous paleomagnetic research of Fruška Gora (LESIĆ *et al.* 2007; CVETKOV *et al.* 2004) has shown that the Upper Cretaceous flysch (with an overprint component) and the Rakovac latites which intrude them have rotated in a clockwise direction (D = 220°, I = –43°, k = 25, α_{95} = 16°). Because this observation is made only on paleomagnetic data obtained for the block north of the Srem dislocation located in the northern Fruška Gora structural unit, an additional paleomagnetic investigation was carried out to show whether the clockwise (CW) rotation obtained for the period after the intrusion of latites during Oligocene–Early Miocene was a consequence of regional movement or relative movement of the block with respect to the rest of Fruška Gora. The investigation was carried out on magmatic rocks situated south of the Srem dislocation (the southern FG structural unit) and north of the Srem dislocation beneath the Petrovaradin fortress. Also, magmatic rocks exposed in the far east

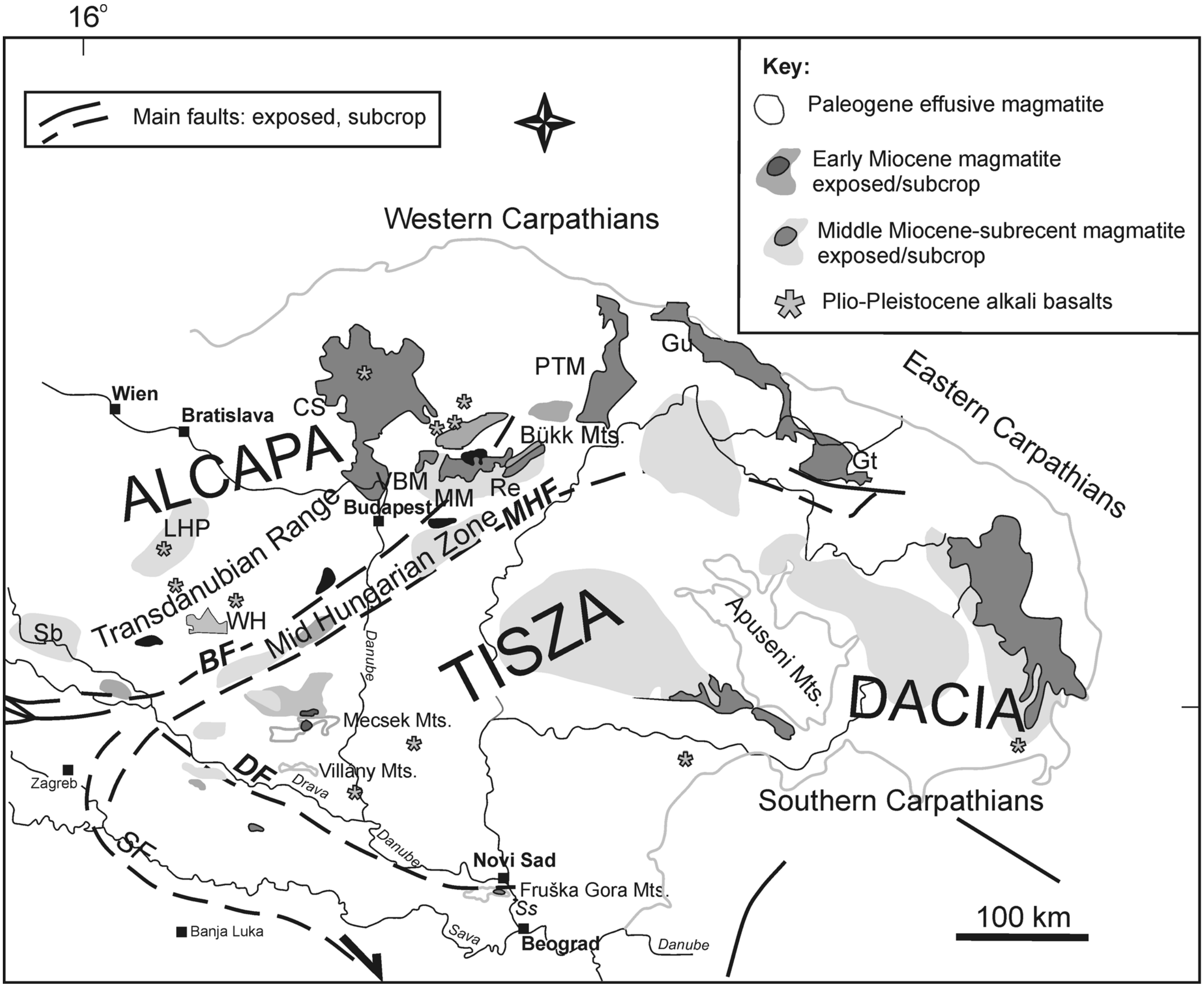

Fig. 1. Major tectonic units and spatial distribution of Paleogene to mid-Miocene magmatic rocks of the Pannonian Basin (after KOVÁCS *et al.* 2007).

Eocene/Oligocene-Miocene magmatic rocks formed during postcollisional setting in the Serbian part of the South Pannonian Basin are accessible for paleomagnetic investigation on Fruška Gora (FG). The main aim is the reconstruction of the amount and the direction of the paleorotation after the intrusion (Fig. 2).

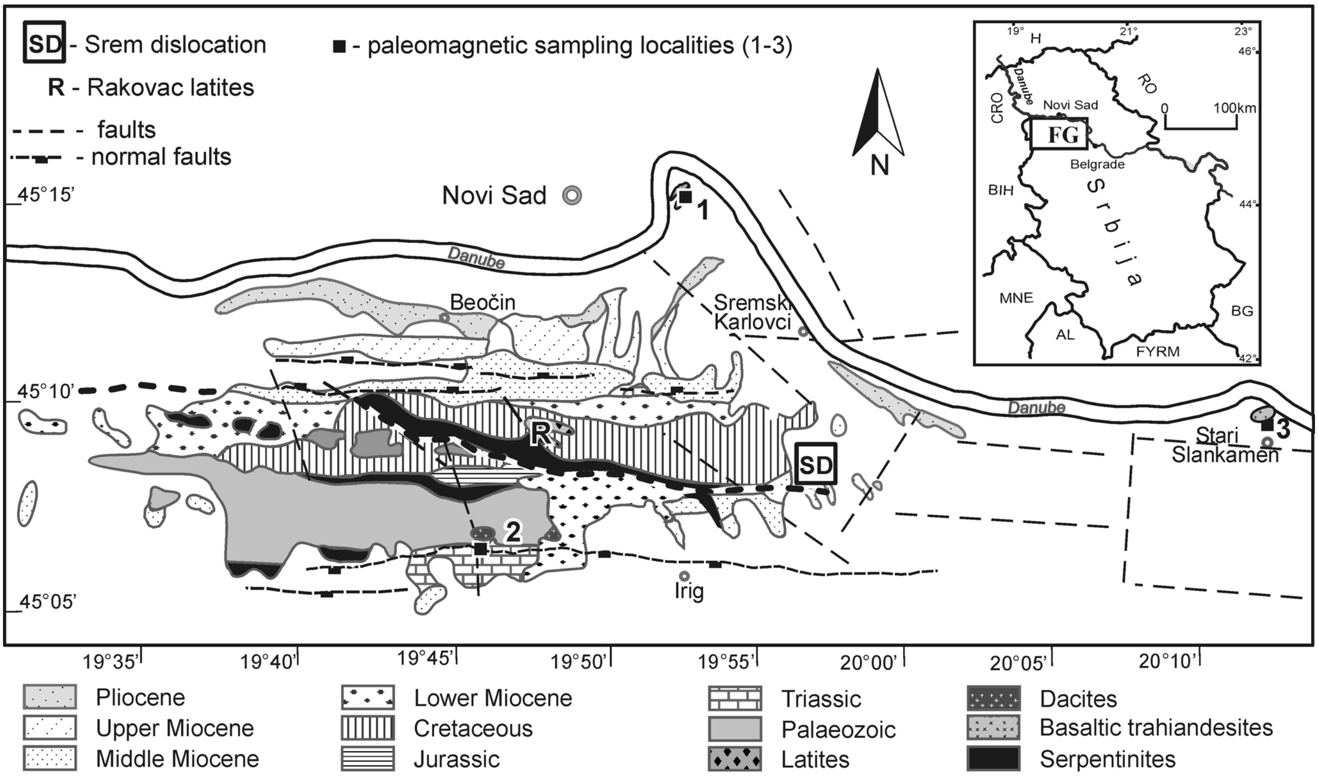

Fig. 2. Geological sketch map of Fruška Gora (FG) (after Čičulić-Trifunović & Rakić 1971, 1984; Petković *et al*. 1976; Dimitrijević 1997) with paleomagnetic sampling localities.

of the FG on the right bank of the Danube River were investigated. According to Marović *et al.* (1996 based on the position of the Neoalpine structures in the area of Vojvodina – the Serbian part of the South Pannonian Basin (Fig. 2)), they belong to Fruška Gora.

Geological background

Magmatic rocks of the Fruška Gora have been the subject of geological investigation since the second half of the 19th century, when the first geological maps of Fruška Gora were made (Lenz 1874, Koch 1876) and the massive eruptive rocks were separated. Petrological characteristics and the origin of these volcanics classified as trachyte, latite or trachyandesite are described by Kišpatić (1882), Tućan (1907) and Knežević *et al*. (1991). There, on a relatively small area (80 km long and only 15 km wide), so far two volcanic phases during Tertiary time have been distinguished. The first one is related to the extrusions of latites, dacito-andesite and rhyodacites in Oligocene (31.6–36 Ma), and the second to the extrusion of basaltic trachyandesite in Miocene i.e. in Badenian time (Knežević *et al*. 1991, Matović & Milovanović 1998; Vasković *et al*. 2010). These volcanics are linked, spatially and temporally, with the same rock types evolved during Paleogene–Early Miocene within the Pannonian basin (Kovács *et al*. 2007).

The main feature of this tectonic phase is opposite rotations of Alcapa and Tisza-Dacia microplates within the Carpathian–Pannonian area (Márton, 1987; Csontos *et al*. 2002). The paleomagnetic data recorded in Paleogene–early Miocene rocks (Márton, 1987) imply that these microcontinents were detached from the Dinarides and pushed/rotated into the Carpathian embayment (Kovács *et al*. 2007).

There is still no agreement about the geotectonic affiliation of Fruška Gora. The reported structural relationships of the pre-Tertiary formations, their lithological and petrological features, age and paleontological data imply the existence of several opinions about its geotectonic evolution. The FG is exposed on the most northern part of the Western Vardar Zone (Karamata & Krstić 1996; Dimitrijević 1997) where the closure of the Vardar Ocean started in Early Cretaceous (123 ± 5 Ma) by the subduction of the oceanic crust towards the NE (Milovanović *et al*. 1995) and ended by the obduction with the northern vergence just above the Periadriatic suture (Grubić *et al.* 1998). According to Pamić (2000), the FG belongs to the Sava Zone recorded as a Late Cretaceous-Early Paleogene back-arc basin open till Middle Miocene, formed by the collision of the Internal Dinarides and Tiszia. Recently, the increasingly accepted point of view is of Schmid *et al*. (2008) who also consider the FG ophiolites as a part of the internal Sava Zone, a tectonic unit formed by the collision of Tiszia and the Dacides with the internal Dinarides.

East–west extending Mt. Fruška Gora is bound by the Danube River on the north and Telek hill on the west. At the easternmost side, at the village Stari Slankamen, it is bordered by the right bank of the Danube. Its northern and southern sides are bound by regional normal faults (Fig. 2). Upper Cretaceous and older rocks are strongly tectonised (DIMITRIJEVIĆ 1997). The Tertiary tectonic movements caused breaking of the FG into sub-blocks which are overlain by Neogene sediments.

The FG is made of Paleozoic, Mesozoic and Tertiary lithological units. The oldest, Paleozoic metamorphic rocks are in tectonic contact with Triassic sediments (Fig. 2). Triassic sediments are mainly developed on the southern slopes. Upper Triassic through mid-Jurassic is not exposed. In the central part the Upper Jurassic basic magmatic rocks and serpentinised peridotites (ophiolites) occur in three zones. Two types of Cretaceous development are found in the tectonic units separated by Srem dislocation (Fig. 2). The first (south of SD) comprises shallow water clastics and reef limestones, the second (north of SD) deep-water flysch deposits. During the Eocene–Miocene latites (KNEŽEVIĆ *et al*. 1991) and dacito-andesites are extruded. Their pyroclastics can be found on the northern slopes of Fruška Gora (PETKOVIĆ *et al.* 1976).

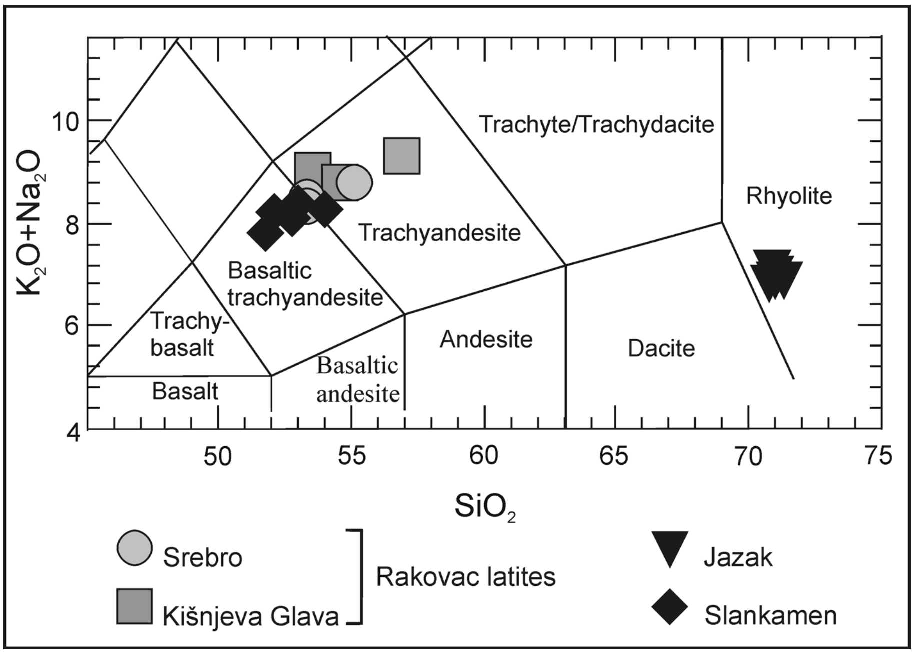

Fig. 3. Classification of the volcanics from the Mt. Fruška Gora according to SiO_2 vs. ($Na_2O + K_2O$) diagram (LA MAITRE *et. al*. 1989).

The latites of Rakovac occur in the central part of Fruška Gora, in the form of elongated bodies striking E–W, or as small intrusions below the Petrovaradin fortress. They are intruded into Triassic limestones, Upper Jurrasic serpentinites and Upper Cretaceous flysch. Based on data obtained from boreholes SIMIĆ & SIMIĆ (2002) reported the occurrence of Rakovac latites in the form of clustered dikes which form conjugate pairs in the deeper levels and make up a larger body. The latites occurring as nearly vertical dykes below the Petrovaradin fortress have the same features as the previously (PETKOVIĆ *et al.* 1976; VASKOVIĆ *et al.* 2010). ČIČULIĆ & RAKIĆ (1971) determined Tertiary magmatic rocks south of the Srem dislocation as dacites and andesites. Later on VASKOVIĆ *et al.* (2010) classified them as rhyodacites (Fig. 3). These rocks occur along the regional fault zone striking E–W, which spreads from Hopovo to the valley of the Beli potok in the area of Jazak village (ČIČULIĆ-TRIFUNOVIĆ & RAKIĆ 1971). According to the position of these magmatic rocks with the respect to the Paleozoic, Triassic and Lower Miocene rocks as well as the presence of accessory minerals in bentonites of the Vrdnik coal-bearing Miocene series, the extrusion of dacito-andesite (i.e. rhyodacite after VASKOVIĆ *et al.* 2010) occurred in several phases during Oligocene–Mid Miocene (ČIČULIĆ-TRIFUNOVIĆ & RAKIĆ 1971; PETKOVIĆ *et al*. 1976). Recently, VASKOVIĆ *et al*. (2010) have limited their age to Oligocene, although additional isotopic age data is required, e.g. K–Ar.

The magmatic rocks on the right bank of the Danube River in the vicinity of Stari Slankamen, not mapped on the basic geological map of SFRJ, sheet "Inđija" 1:100000 (ČIČULIĆ-TRIFUNOVIĆ *et al*. 1984), are classified as basaltic trachyandesites (VASKOVIĆ *et al*. 2010) probably of Miocene age (Fig. 3).

Lacustrine sediments of Lower Miocene age and Badenian to Pontian sediments occur at the marginal parts and in the base of FG. Pliocene is represented by lacustrine Paludian beds.

Based on the difference in the development of geological formations, their position and characteristics of tectonic correlations, PETKOVIĆ *et al.* (1976) and DIMITRIJEVIĆ (1997) distinguish two major structural units (blocks) on the Fruška Gora: the northern Fruška Gora structural unit north of the Srem dislocation (SD) and the southern Fruška Gora structural unit south of SD (Fig. 2).

Materials and Methods

Tertiary magmatic rocks, which are the subject of our investigation, were sampled from the northern side of FG, latitic dykes (locality 1) below the Petrovaradin fortress, rhyodacites (locality 2) near Jazak from the south side of FG, and on the east basaltic trachyandesites (locality 3) near village Stari Slankamen (Fig. 2).

For measuring the magnetic susceptibility, MFK1-A kappabridge (AGICO instrument) was used. The JR-5 spinner magnetometer (AGICO instrument) was used to measure the natural remanent magnetization before demagnetization (NRM) and remanent magnetization (RM) after each step of demagnetization. The intensity and the direction of the RM (shown by the angle of declination (D) and inclination (I)) was measured after each step of demagnetization. For demagnetization an alternating field demagnetizer (AFD300, Magnon instrument) was used.

First the NRM of each specimen was measured, followed by the measurement of magnetic susceptibility. Then, pilot specimens from each locality were subjected to detailed stepwise alternating field (AF) demagnetization until the RM signal was lost. Based on the behavior of pilot specimens, steps for AF demagnetization of the remaining specimens were chosen.

It was important during demagnetization to remove any secondary magnetization and identify the characteristic remanent magnetization (ChRM, remanence preserved in the sample). The demagnetization curves were analyzed using principle component analysis (KIRSCHVINK 1980) to determine the ChRM and then subjected to statistical evaluation (FISHER 1953) to determine the mean paleomagnetic direction on locality level and the overall-mean paleomagnetic direction for all localities.

Paleomagnetic sampling, measurements and results

We drilled 33 cores from 3 localities using a portable drilling machine and oriented the cores with the magnetic and sun compasses in the field (Fig. 2). Latites (locality 1) were sampled from two dykes (since the distance between them was a few meters they are regarded as one locality with two sampling sites). From the first dyke, which was visually fresher, 7 cores were drilled and from the second dyke 3 cores were drilled. The value of magnetic susceptibility varies from 34450–53420 × 10^{-6} SI and the intensity of NRM from 300–600 mA/m. The maximum field used for demagnetization of specimens from the first dyke is 70 mT, while for the second dyke it was 210 mT.

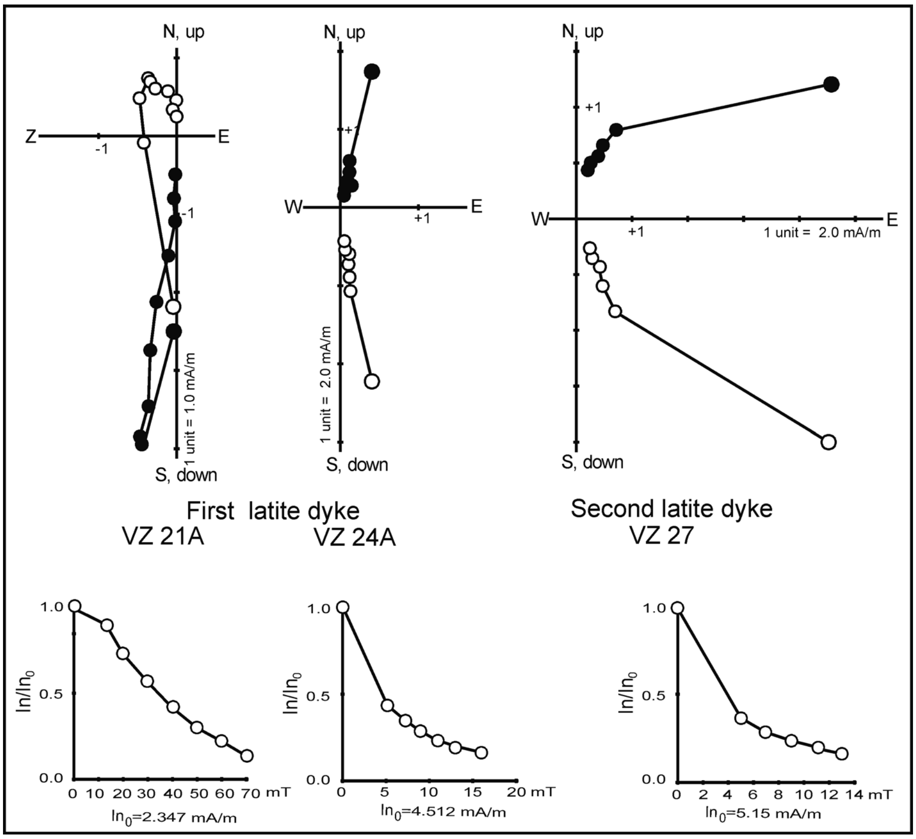

Fig. 4. Fruška Gora, latites. Typical demagnetization curves. Key: Upper row – Zijderveld diagrams (full/open circles: projection of the NRM in the horizontal/vertical plane). Lower row – Normalized NRM intesity as a function of demagnetizing field. In_0 - initial intesity of the NRM.

After AF demagnetization, contrary to our expectation only the specimens from the second dyke had ChRM (Fig. 4).

Specimens from the first dyke had a secondary remanent magnetization which overprinted the primary one. Inclinations of four specimens were too shallow, while the other three had declinations and inclinations which coincide with the local geomagnetic field (Fig. 4).

The microscopic inspection of latite thin sections shows that the samples from the first dyke are hydrothermally altered and that their central part is highly calcitised (80 vol.%). Phenocrysts of amphibole and pyroxene are generally partly to completely chloritised and comprise secondary magnetite. The latite samples from the second dyke were much fresher under the microscope. The remanent magnetization is of normal polarity (Table 1).

Three good results of ten indicate that the mean paleo-

Table 1**.** Summary of locality mean palaeomagnetic directions, based on the results of principal component analysis (KIRSCHVINK 1980). Key: n/n_0 - number used/collected (the samples are independently oriented cores); *D*, *I* - declination, inclination; *k* and α_{95} - stastistical parameters (FISHER 1953); * directions are used in paleomagnetic interpretation.

	Locality	Lat. N Lon. E	n/n_0	$D°$	$I°$	k	α_{95}
1	*Petrovaradin fortress latites VZ 20-29	45°14'49" 19°52'16"	3/10	36	+60	87	13
2	*Jazak rhyodacites VZ 82-96	45°16'59" 20°21'19"	12/15	243	-73	74	6
3	Slankamen basaltic trachyandesites VZ 167-174	45°07'19" 19°45'49"	8/8	18	+71	97	6

magnetic direction is of low confidence (MÁRTON 1993), but if we take into account that the defined ChRM for specimens from the second dyke coincide with the primary remanent magnetization of Rakovac latites (LESIĆ *et al.* 2007) then it is justified to use the mean paleomagnetic direction for latites (locality 1) for defining the overall mean paleomagnetic direction for magmatic rocks of Fruška Gora.

Rhyodacites (locality 2) were sampled from the middle part of the Beli potok stream. Although the rocks looked altered on the surface, the crushed surface is fresh which was proven by petrological analysis. The traces of alteration are recorded only on plagioclase phenocrysts in the form of micron-sized flakes of sericite. The position of the dyke in the field could not be precisely defined due to thick cover - for that reason we sampled only four sites along the stream and drilled all together 15 cores. The value of magnetic susceptibility varies from 50.76–67.68 × 10^{-6} SI and the initial intensity of NRM from 1.99–5.71 mA/m. The maximum field used for demagnetization is 100 mT. During demagnetization, the demagnetization path in all specimens decayed towards the origin of Zijderveld diagram (Fig. 5). The remanent magnetization is of reversal polarity (Table 1).

The outcrop of basaltic trachyandesites (locality 3) is around 15 m long and 10 m high. Mainly it is covered with young loess sediments. On the crushed surface, rocks are fresh and dark gray in color. Eight cores from three sites were drilled. The value of magnetic susceptibility varies from 39770–45310 × 10^{-6} SI and the initial intensity of NRM from 947–1148 mA/m. The maximum field used for demagnetization is 15 mT. During demagnetization, the demagnetization path in all specimens did not decay towards the origin, which pointed to a magnetization probably acquired due to weathering and alteration. Also, the direction of the

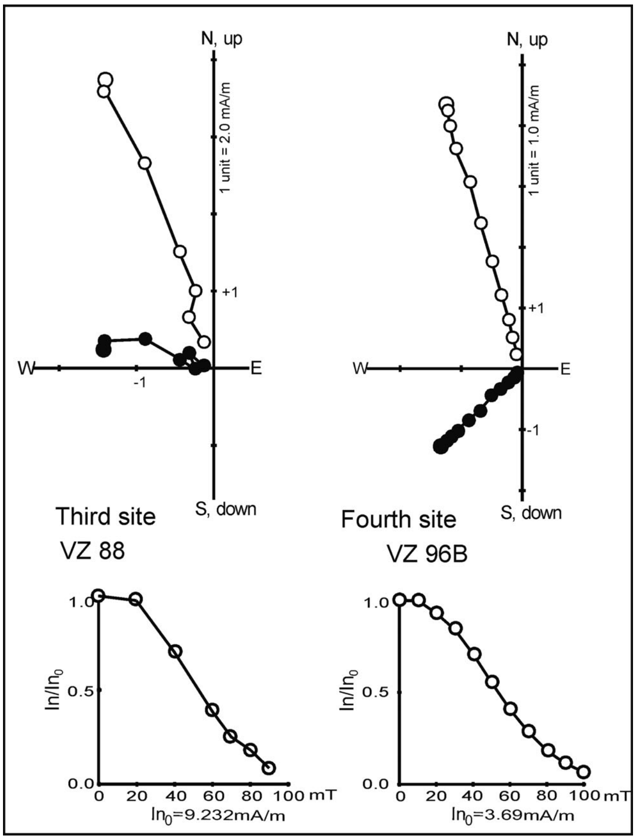

Fig. 5. Fruška Gora, rhyodacites. Typical demagnetization curves. Key as for Fig 4.

RM coincides with a N–S direction which supports the premise that the overprint was acquired in the magnetic field of present day Earth (Fig. 6, Table 1).

Discussion and conclusions

The new results of paleomagnetic investigation of Tertiary magmatic rocks from Fruška Gora can be divided into two groups. The first group comprises the results obtained from basaltic trachyandesites (locality 3) near Stari Slankamen – it is characterized by the remanent magnetization with high positive inclination and declination slightly deviated from the North, most probably acquired in the present day geomagnetic field during weathering. The second group comprises results obtained from latites (locality 1) below the Petrovaradin fortress from the north side and the rhyodacites (locality 2) from the south side of the crest of Fruška Gora – it is characterized by a stable remanent magnetization which is parallel with the vector of primary remanent magnetization of Rakovac latites (quarries Srebro, Kišnjeva Glava and Gradac) and the Upper Cretaceous flysch (with an overprint component) intruded by the Rakovac latites (CVETKOV *et al.* 2004; LESIĆ *et al.* 2007).

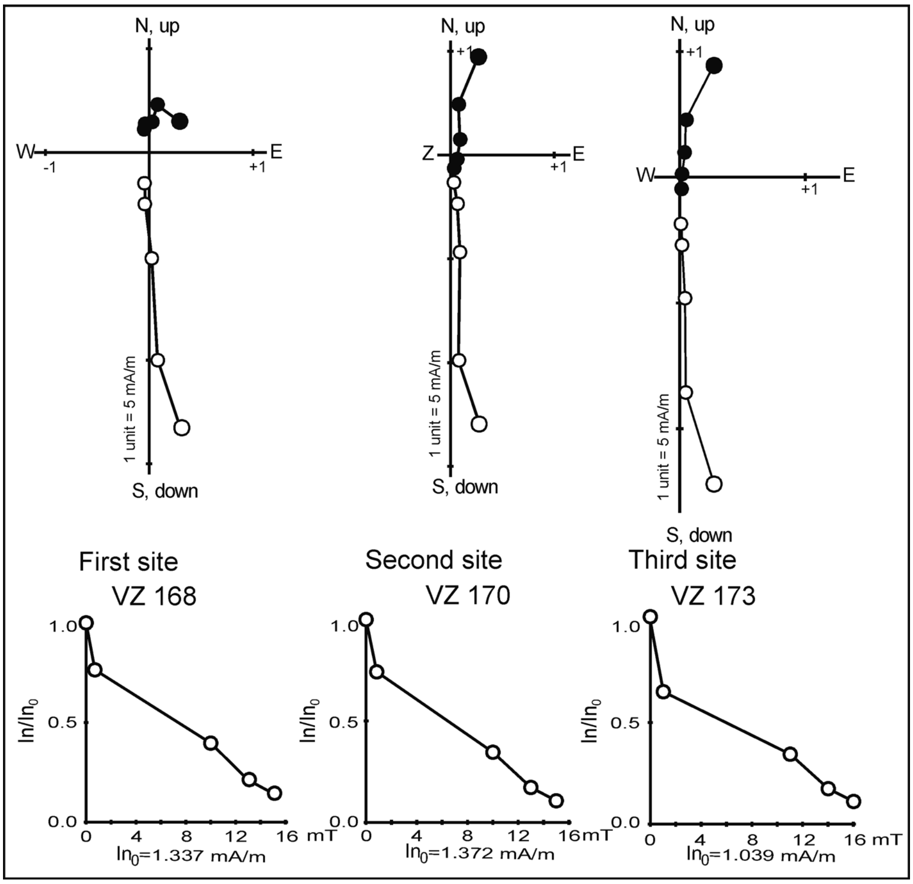

Fig. 6. Fruška Gora, basaltic trachyandesites. Typical demagnetization curves. Key as for Fig 4.

Latites below the Petrovaradin fortress have easterly oriented declination like the rhyodacites and the main latitic mass of the Rakovac but the polarity of the ChRM is positive (Table 1). According to the mineralogical-petrological and isotopic K/Ar data (KNEŽEVIĆ *et al.* 1991; VASKOVIĆ *et al.* 2010) and also the position of the studied localities on magnetostratigraphic scale (C12-R, C13, C15 and C16-NR1, OGG *et al.* 2008) it can be concluded that latites from Mt. Fruška Gora came from the same magmatic source and that they extruded during the same tectonic activity, at one of the three mentioned changes of the polarity of the Earth's magnetic field. The difference in the polarity of the primary remanent magnetization of latite dykes below the Petrovaradin fortress and the considerably bigger latite mass of Rakovac is most probably due to the faster cooling down of the former from the latter.

The overall-mean paleomagnetic direction of magmatic rocks from Fruška Gora with respect to the North suggests a considerable CW rotation of about 91° (Fig. 7). Considering that the Lower Miocene sediments are tilted and assuming that the magmatic rocks were affected by the same tectonic event, a tilt correction can be applied on the obtained direction for magmatic rocks. The tilt correction for the structural elements of Lower Miocene sediments (tilt angle of 41° towards 3° N) was statistically calculated from the data read from the basic geological map of SFRJ, sheet Novi Sad 1:100 000 (ČIČULIĆ-TRIFUNOVIĆ 1984). After applying the tilt correction, the overall mean paleomagnetic direction for magmatic rocks (D = 210°, I = –45°, k = 21, α_{95} = 14°) exhibits a more moderate CW rotation of 30° with respect to the North. The fact that close to the end of Miocene-Early Pliocene Mt. Fruška Gora rotated in a counterclockwise direction for 40° with the respect to the present North (LESIĆ *et al.* 2007) suggests a total of 70° of clockwise rotation for the period after the intrusion of magmatic rocks and before mid-Miocene.

The latest Miocene–pre-middle-Pliocene counterclockwise rotation of Mt. Fruška Gora which affected the Miocene and Mesozoic sediments is not recorded by the magmatic rocks. The reason for this most probably lies in the magnetic characteristics of the NRM of the studied magmatic rocks.

Since the paleomagnetic investigations were carried out on both sides of the Srem dislocation, both in the northern and southern Mt. Fruška Gora structural units, the obtained CW rotation is of regional significance and is connected to the period of the end of Eocene–beginning of Oligocene till the beginning of mid-Miocene. Then the CCW rotation of Mt. Fruška Gora begins, most probably induced by the influence of the Adriatic microplate (MÁRTON 2005; MÁRTON *et al.* 2011).

When analyzing the extensional structures in the territory of Vojvodina (Serbian part of the South Pannonian Basin) MAROVIĆ *et al.* (1996, 2007) concluded that the beginning of bending and movement of the pre-Neogene basement south of the Trans–Banat–Bačka dislocation is a consequence of the incorporation of Tiszia in the southern part of the future Pannonian Basin system during Upper Paleogene–Lower Miocene. The eastward movement of Tiszia and the CW rotation led to the transportation of southeastern Pannonian units towards NE with progressive eastward and southeastward movement which, ac-

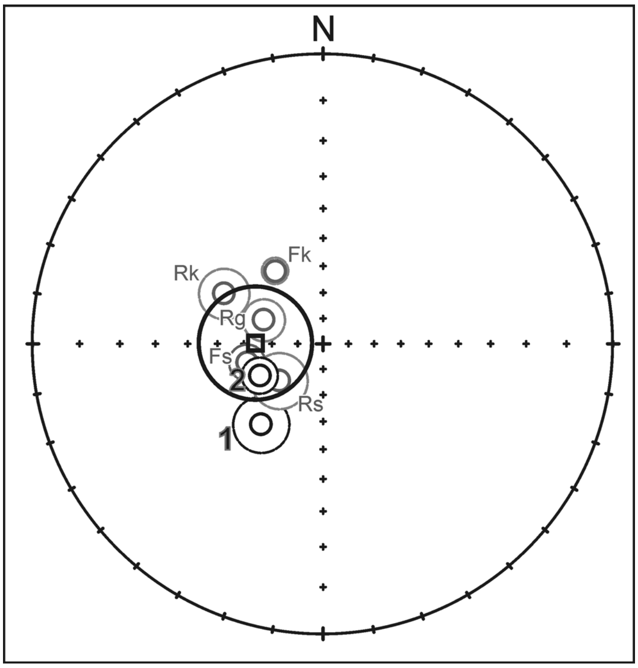

Fig. 7. Fruška Gora, magmatic rocks of Eocene/Oligocene age and Upper Cretaceous flysch. Locality mean paleomagnetic directions with α_{95} for: latite beneath the Petrovaradin fortress (1) originally of reversed polarity and rhyodacites (2) – present study; Rakovac latites: quarries Srebro (Rs), Kišnjeva Glava (Rk), Gradac (Rg) and Upper Cretacous intruded flysch: quarries Srebro (Fs) and Kišnjeva Glava (Fk) after LESIĆ *et al.* (2007). The overall-mean paleomagnetic direction (square) with α_{95} is also ploted. Key: open circles: negative inclination. Stereographic projection.

cording to the authors, represents in fact a clockwise rotation.

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Резиме

Нови палеомагнетски подаци из терцијарних магматита Фрушке горе, Србија

Само на неколико места у јужном Панонском басену, као што је на Фрушкој гори, терцијарни магматити нису покривени неогеним седиментима и доступни су за палеомагнетска испитивања са циљем реконструкције њихове кинематичке еволуције. Фрушка гора је једна велика антиформа, пружања И–З, која је са севера ограничена Дунавом, западну границу чини брдо Телек, а источну десна обала Дунава код Старог Сланкамена. На основу разлика у развићу геолошких формација, њиховог распореда и карактеристика тектонских односа, ПЕТКОВИЋ *и др.* (1976) и DIMITRIJEVIĆ (1997) издвајају две главне структурне целине (блока) – севернофрушкогорску структурну јединицу северно од сремске дислокације и јужнофрушкогорску структурну јединицу јужно од сремске дислокације. Током еоцена–олигоцена у палеозојске–мезозојске творевине екструдовани су вулканити латитског (KNEŽEVIĆ *et al.* 1991) и риодацитског (VASKOVIĆ *et al.* 2010) типа који су уједно и најстарије вулканске стене у јужном делу Панонског басена (MATOVIĆ & MILOVANOVIĆ 1998). У близини села Стари Сланкамен јављају се базалтни трахиандезити миоценске старости (VASKOVIĆ *et al*. 2010).

Током ранијих палеомагнетских истраживања (CVETKOV *et al.* 2004; LESIĆ *et al.* 2007) испитана је главна латитска маса тзв. Раковачки латити (каменоломи Сребро, Кишњева Глава и Градац и кредни седименти у њиховој околини на које су латити извршили магнетски "*overprint*") северно од Сремске дислокације. Нова палеомагнетска испитивања, представљена у овом раду, обављена су на локалитетима знато удаљеним од главне латитске масе и на вулканитима са јужне стране Сремске дислокације. Узорковани су латити испод Петроварадинске тврђаве који се јављају у виду скоро вертикалних дајкова који пресецају базичне магматске стене горњотријаске или јурске старости, базалтни трахиандезити код Старог Сланкамена и риодацити код Јаска који су утиснути дуж регионалне раседне зоне пружања И–З.

Укупно је избушено 33 оријентисана језгра која су подвргнута стандардним лабораторијским испитивањина: мерење иницијалне вредности магнетске сусцептибилности, интезитета реманентне магнетизације у домену тоталне природне реманентне магнетизације као и након сваког корака демагнетизације у наизменичном магнетском пољу.

Добијени резултати се могу поделити у две групе. У првој групи су подаци из базалтних трахиандезита Сланкамена који се одликују високом позитивном инклинацијом и деклинацијом незна-

тно отклоњеном од севера, највероватније стеченом у савременом геомагнетском пољу приликом површинског распадања стена. У другој групи су резултати, добијени из латита испод Петроварадинске трђаве и риодацита Јаска, коришћени у тектонској интерпретацији. Положај стабилне реманентне магнетизације друге групе колинеаран је са вектором примарне реманентне магнетизације Раковачких латита (CVETKOV *et al*. 2004; LESIĆ *et al.* 2007), с том разликом што латити испод Петроварадинске тврђаве поседују позитиван поларитет примарне реманентне магнетизације. На основу минералошко-петролошких (VASKOVIĆ *et al.* 2010) и изотопских (К/Ар метода, KNEŽEVIĆ *et al.* 1991) испитивања и положаја испитиваних локалитета на магнетостратиграфској скали (C12-R, C13, C15 и C16-NR1; OGG *et al.* 2008) може се закључити да фрушкогорски латити потичу из истог магматског извора, да су утиснути током исте тектонске активности, на граници једне од три промене поларитета магнетског поља Земље, при чему се жична појава латита испод Петроварадинске тврђаве највероватније брже охладила од знатно веће Раковачке масе, што је произвело разлику у поларитету примарне реманентне магнетизације.

Општи средњи правац вулканита Фрушке горе у односу на савремен правац севера указује на знатну ротацију, од 91° у смеру кретања казаљке на сату. С обзиром да су доњомиоценски седименти деформисани и ако претпоставимо да су магматске стене захваћене истом тектонском фазом, може се применити корекција за тектонику добијена статистичком анализом елемената склопа доњомиоценских седимената очитаних са ОГК лист Нови Сад 1: 100 000 (ČIČULIĆ-TRIFUNOVIĆ & RAKIĆ 1971). Елементи за ову корекцију су падни угао од 41° и правац пада од 3° северно. Након примењене корекције, добијена је умеренија ротација општег средњег правца вулканита (D = 210°, I = –45, k = 21, α_{95} = 14°) од 30° у смеру казаљке на сату, што указује на укупну ротацију од око 70° у смеру казаљке на сату, за период после екструдовања вулканита и пре средњег миоцена, с обзиром да је Фрушка гора претрпела хоризонталну ротацију од 40° у смеру супротном од кретања казаљке на сату крајем миоцена почетком плиоцена (LESIĆ *et al*. 2007).

Палеомагнетска испитивања су обављена са обе стране сремске дислокације а добијена ротација у правцу казањке на сату је од регионалног значаја и везује се за крај еоцена/почетак олигоцена до почетка миоцена, када доминанту улогу преузима ротација у смеру супротном од кретања казаљке на сату услед утицаја Јадранске микроплоче (MÁRTON 2005).