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# DISTRIBUTION OF SOME RARE ELEMENTS IN THECHAM DERE PALEOGENE MAGMATIC GROUP, EASTERN RHODOPES

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**ABSTRACT.** The Cham Dere Group is composed of the acidic magmatic rocks from the late extensional Paleogene magmatism in the Northeastern Phodopean Depression. This group includes the sequentially formed complexes as follows: Borovitsa rhyolite, Bryagovo rhyolite, Panichkovo trachyrhyolite, Murgen trachyrhyolite, Gradishte trachyrhyodacite, and Tri Mogili dyke ones.
These complexes are characterized with close contents of the studied rare elements (Rb, Nb, Y, Zr, Sr), which supports the assumption that the rocks are a result of the evolution of common magma chamber.
The results from the diagrams constructed to evaluate the type of tectonic environment are rather contradictory (Nb-Y; Rb-Y+Nd; Y-$SiO_2$; Nb-$SiO_2$; Rb/Zr-$SiO_2$). This is, probably due to the fact that these diagrams do not count for regions of extension as is accepted for the Rhodopean Massif. From the results obtained it can be concluded that using only one type of diagram to determine the tectonic environment is incorrect and unreliable.

**РАЗПРЕДЕЛЕНИЕ НА НЯКОИ РЕДКИ ЕЛЕМЕНТИ В ПАЛЕОГЕНСКАТА ЧАМДЕРЕНСКА МАГМЕНА ГРУПА В ИЗТОЧНИТЕ РОДОПИ**

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**РЕЗЮМЕ.** Чамдеренската група обединява киселите магмени скали на късноекстензионния палеогенски магматизъм в Североизточнородопската депресия. Тя включва последователно формираните Боровишки риолитов, Бряговски риолитов, Паничковски трахириолитов, Мургенски трахириолитов, Градищенски трахириолитов и Тримогилски дайков комплекси.
Тези комплекси се характеризират с близки съдържанията на изследваните редки елементи (Rb, Nb, Y, Zr, Sr), което подкрепя предположението, че те са резултат на еволюцията на една обща магмена камера.
Резултатите от дискриминационните диаграми за типа на тектонската обстановка са силно противотечиви (Nb-Y; Rb-Y+Nd; Rb-$SiO_2$; Y-$SiO_2$; Nb-$SiO_2$; Rb/Zr-$SiO_2$). Това вероятно се дължи на факта, че те не отчитат областите на екстензия, за каквато се възприема Родопският масив. От получените резултати може да се направи извода, че определянето на типа на тектонската обстановка само по един тип диаграма е ненадеждно и некоректно.

## Geological setting

Cham Dere magmatic Group includes the acidic volcanic rocks of the Northeastern Rhodopean Depression (Borovitsa volcanic region according to Иванов, 1960). This depression has formed during Paleogene in the region between the Central Rhodopen Dome and the Harmanli Block. Its origination has been connected with the processes of extension and exhumation of the metamorphic core complexes in the Rhodopean Massif (Ivanov, 2000; Georgiev, 2004, 2005).

Terrigeneous and carbonate rocks have deposited at the base of the depression during Paleocene-Eocene. At the end of Priabonian and during Rupelian the depression has been an arena of intensive volcanic activity. The initial magmatic acts in the region (Priabonian-Lower Rupelian) are characterized by medium acidic composition (Surnitsa Group; Георгиев, Милованов, 2006a). The later phases (Rupelian) are of acidic composition (Cham Dere acidic Group; Георгиев, Милованов, 2006b). The materials of Cham Dere Group display differentiated areal of distribution and it as been proposed that they are a result of the activity of one magmatic chamber (Georgiev, Milovanov, 2005).

The magmatic rocks of Cham Dere Group fill up the Borovitsa caldera (volcano-tectonic depression; Иванов, 1960). Also, several extrusions, tens of dykes and rare tuff spots crop out beyond the caldera boundaries (Fig. 1). They are localized predominantly in east-northeast direction from the caldera and mainly along the Bukovitsa fault sheaf (Topolovo-Pilashevo fault belt, Боянов, Маврудчиев, 1961).

The following complexes have been distinduidhed in Cham Dere magmatic group (Георгиев, Милованов, 2006б): Borovitsa rhyolite, Panichkovo trachyrhyolite, Murgen trachyrhyolite, Gradishte trachyrhyodacite, Tri Mogili dyke, and Bryagovo rhyolite ones. The rocks of Borovitsa, Murgen, and

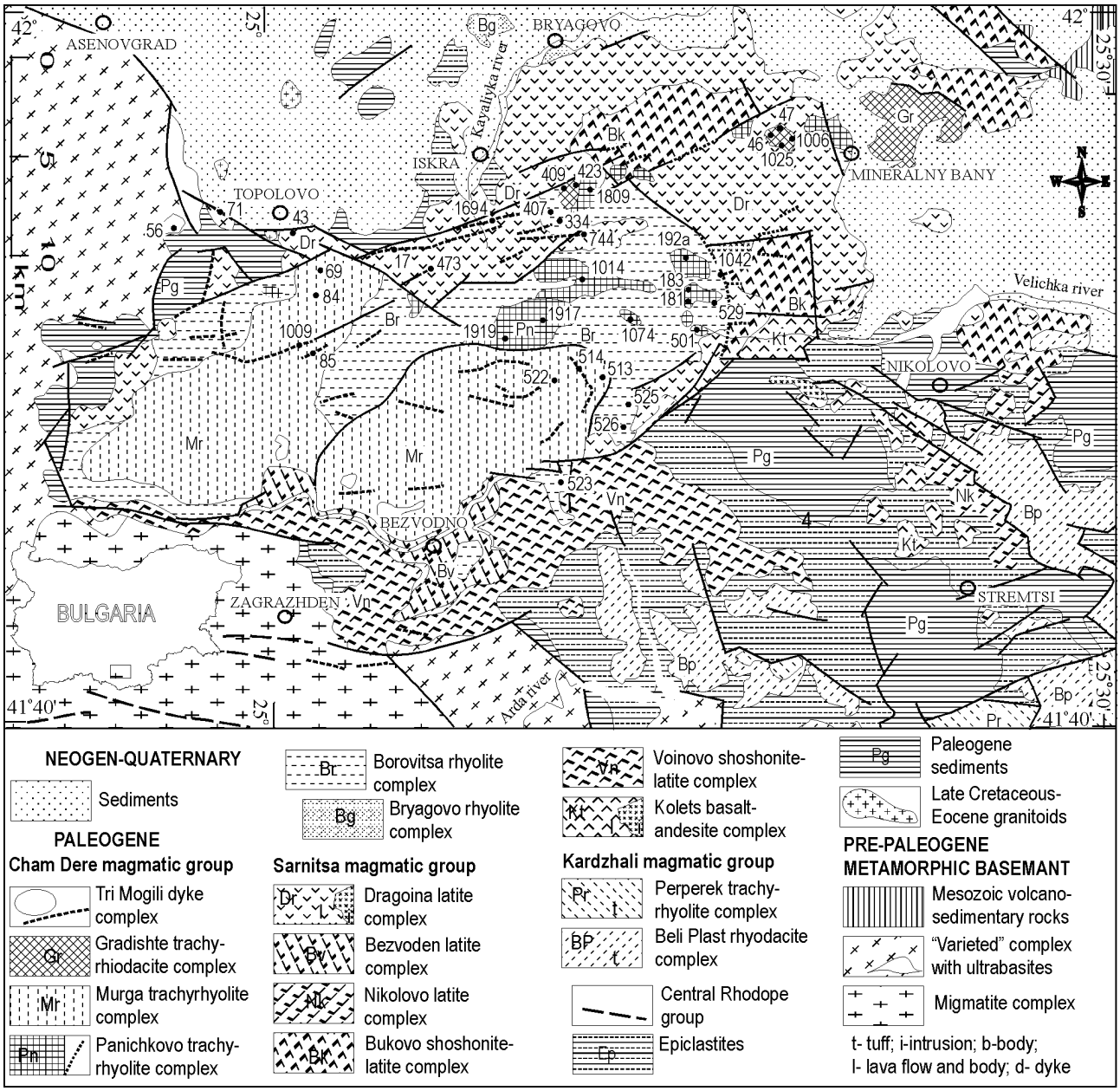


**Fig. 1. Map of magmatic complexes in the Northeastern Rhodope Depression**

Bryagovo complexes display explosive facies and those of Panichkovo, Gradishte, and Tri Mogili – effusive and subvilcanic ones.

## Results

Significant differences in the distribution of the studied rare elements (Rb, Nb, Y, Zr, Sr) are not registered for the specified complexes of Cham Dere group (Fig. 2) Only Borovitsa complex displays a little bit higher contents of strontium.

The results obtained for the character of the tectonic environment by use of the constructed diagrams are contradictory and under discussion (Fig. 3). The points even from one and the same complex fall in fields of different tectonic environments. A very rough tendency is observed for prevalence of points in the fields of the collisional and syncollisional granites. For Surnitsa medium acidic magmatic group from the same depression the tendency is different. In this case the points fall in the fields of the within plate granites.

## Discussion

The rocks of the separate complexes of Cham Dere magmatic Group do not differ significantly in respect to contents of the studied rare elements (Rb, Nb, Y, Zr, Sr). The obtained data support the assumption that the magmatic complexes of Surnitsa Group have a common origin and are result of a separate phase from the development of one magma chamber (Георгиев, Милованов, 2006б).

On the constructed diagrams the results for the type of tectonic environmentare very contradictory and mutually excluding. This is probably due to the fact that it was not

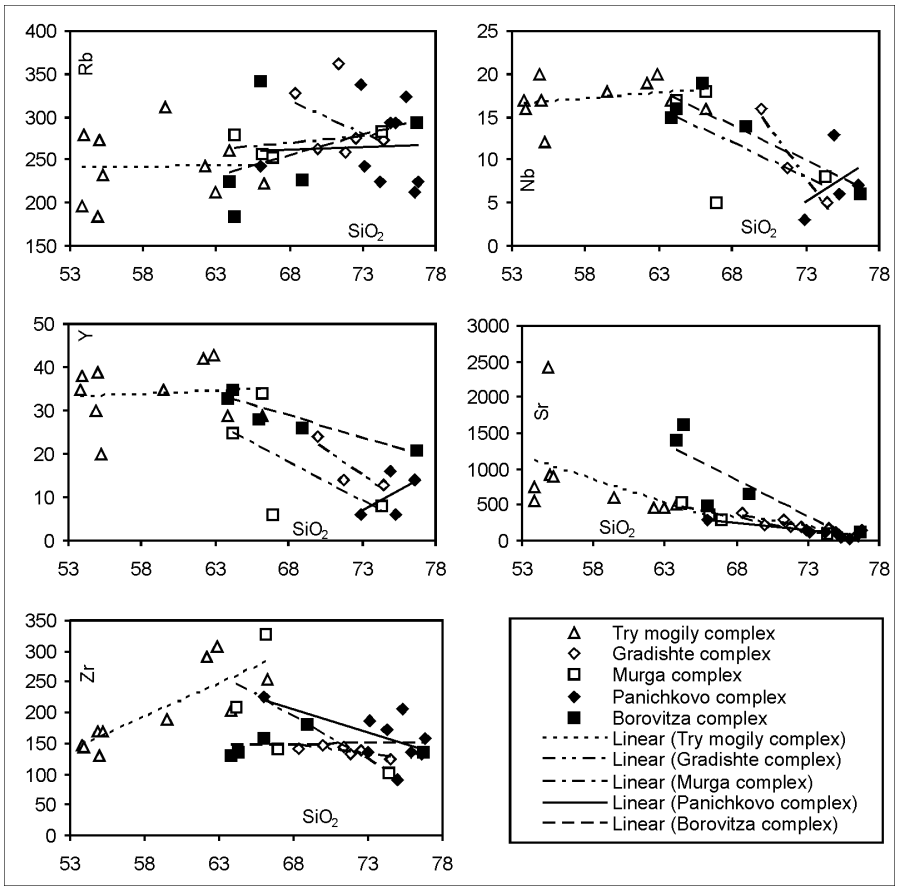


**Fig. 2. Diagrams showing distribution of Rb, Nb, Y, Zr, Sr in rocks from the Cham Dere Group**

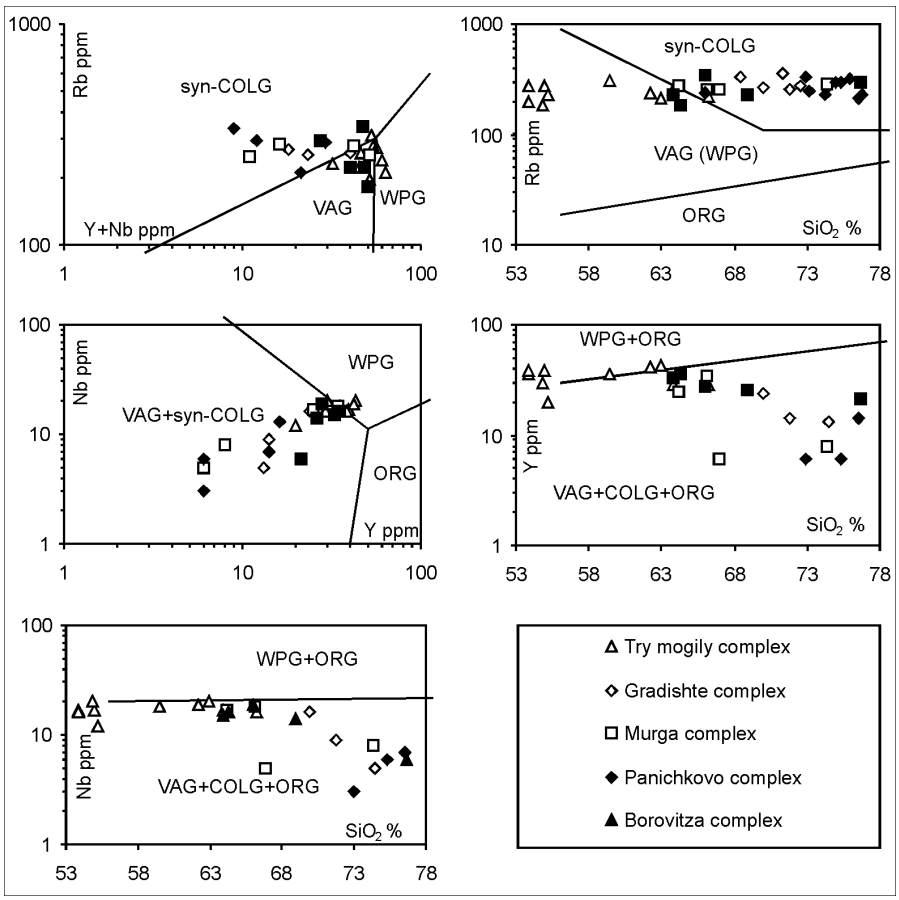


**Fig. 3. Discrimination diagrams for the tectonic environment of the Cham Dere Group (according to Pearce et al., 1984 ; Harris et al., 1986)**

Table 1
*Representative analyses of Chan Dere group*

| No | $SiO_2$ | Rb | Nb | Y | Sr | Zr |
|---|---|---|---|---|---|---|
| Try mogily complex | | | | | | |
| 514 | 53,80 | 197 | 17 | 35 | 567 | 148 |
| 17a | 54,97 | 273 | 17 | 39 | 917 | 130 |
| 1009 | 62,94 | 212 | 20 | 43 | 470 | 307 |
| 56 | 62,20 | 242 | 19 | 42 | 457 | 290 |
| 744 | 59,49 | 311 | 18 | 35 | 600 | 189 |
| 85 | 63,86 | 260 | 17 | 29 | 500 | 202 |
| 1416 | 66,23 | 223 | 16 | 29 | 390 | 253 |
| 473 | 54,87 | 184 | 20 | 30 | 2420 | 168 |
| 43 | 55,20 | 232 | 12 | 20 | 897 | 168 |
| 1694 | 53,89 | 280 | 16 | 38 | 748 | 145 |
| Gradishte complex | | | | | | |
| 409 | 74,50 | 272 | 5 | 13 | 171 | 124 |
| 423 | 71,80 | 258 | 9 | 14 | 201 | 133 |
| 1014 | 69,96 | 262 | 16 | 24 | 215 | 146 |
| 47 | 68,36 | 328 | | | 387 | 142 |
| 48 | 71,32 | 362 | | | 283 | 144 |
| 1025 | 72,50 | 274 | | | 203 | 138 |
| Murga complex | | | | | | |
| 513 | 74,38 | 284 | 8 | 8 | 101 | 103 |
| 522 | 66,90 | 252 | 5 | 6 | 302 | 142 |
| 69 | 66,16 | 257 | 18 | 34 | 370 | 327 |
| 84 | 64,21 | 279 | 17 | 25 | 530 | 210 |
| Panichkovo complex | | | | | | |
| 1917 | 72,96 | 337 | 3 | 6 | 153 | 136 |
| 1919 | 76,55 | 213 | 7 | 14 | 101 | 132 |
| 1809 | 75,30 | 294 | 6 | 6 | 41 | 205 |
| 1042 | 66,00 | 242 | | | 302 | 227 |
| 181 | 74,23 | 225 | | | 123 | 173 |
| 183 | 76,84 | 225 | | | 134 | 158 |
| 192 | 73,16 | 243 | | | 112 | 187 |
| 529 | 74,93 | 293 | 13 | 16 | 117 | 90 |
| 1006 | 75,94 | 323 | | | 30 | 136 |
| Borovitza complex | | | | | | |
| 334 | 68,90 | 226 | 14 | 26 | 655 | 181 |
| 407 | 76,70 | 294 | 6 | 21 | 109 | 135 |
| 523 | 66,00 | 341 | 19 | 28 | 495 | 157 |
| 525 | 63,85 | 225 | 15 | 33 | 1403 | 131 |
| 526 | 64,24 | 185 | 16 | 35 | 1611 | 136 |

counted for the regions of extension as is accepted for the Rhodopean Massif. Yanev (1998) has determined syn-COLD type but using only the $Rb/SiO_2$ diagram and studying only the acidic rocks in Eastern Rhodopes. From the obtain results in this study it can be concluded that determining the type of tectonic environment by use of only one diagram is unreliable an incorrect, especially for the case of the Rhodope massif.

Recommended for publication by the Department of
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