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PETROCHEMICAL PECULIARITIES OF THE CHAM DERE PALEOGENE MAGMATIC GROUP, EASTERN RHODOPES

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ABSTRACT. The Cham Dere Group unites the acidic magmatic rocks of the late extensional Paleogene magmatism in the Northeastern Phodopean Depression. This group includes the sequentially formed Borovitsa rhyolite, Bryagovo rhyolite, Panichkovo trachyrhyolite, Murgen trachyrhyolite, Gradishte trachyrhyodacite, and Tri Mogili dyke complexes.
The rocks of Borovitsa, Panichkovo, Murgen, and Gradishte magmatic complexes are characterized with similar trends of distribution of the main oxides. This supports the ides about a common origin (magma chamber) of the initial magmas. On the K_2O/SiO_2 diagram their distribution trends dispose mainly in the field of the shoshonite series. The more basic varieties of the Tri Mogili complex fall in the field of the high-potassium subalkaline series.

ПЕТРОХИМИЧНИ ОСОБЕНОСТИ НА 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 трахириодацитов, и Тримогилски дайков комплекси.
Скалите от Боровишкия, Паничковския, Мургенския и Градищенския магмени комплекси се характеризират със сходни закономерности в разпределението на основните окиси. Това подкрепя идеята за общ корен (магмена камера) на родоначалните магми. На диаграмата K_2O/SiO_2 техните трендове на разпределение се разполагат главно в шошонитовата серия. По-базичните разновидности на Тримогилския комплекс попадат в полето на висококалиево субалкалната серия.

Introduction

The 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, 2006а). The later phases (Rupelian) are with acidic composition (Cham Dere acidic Group; Георгиев, Милованов, 2006б). The materials of Cham Dere Group display differentiated areal and spreading 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). Several extrusions, tens of dykes and rare tuff spots crop out beyond the caldera boundaries as well (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 separated 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 Bryagovo complexes display explosive facies and those of Panichkovo, Gradishte, and Tri Mogili – effusive and subvilcanic ones.

Results

In respect to SiO_2 content the rocks of Borovitsa, Panichkovo, Murgen and Gradishte complexes are related to

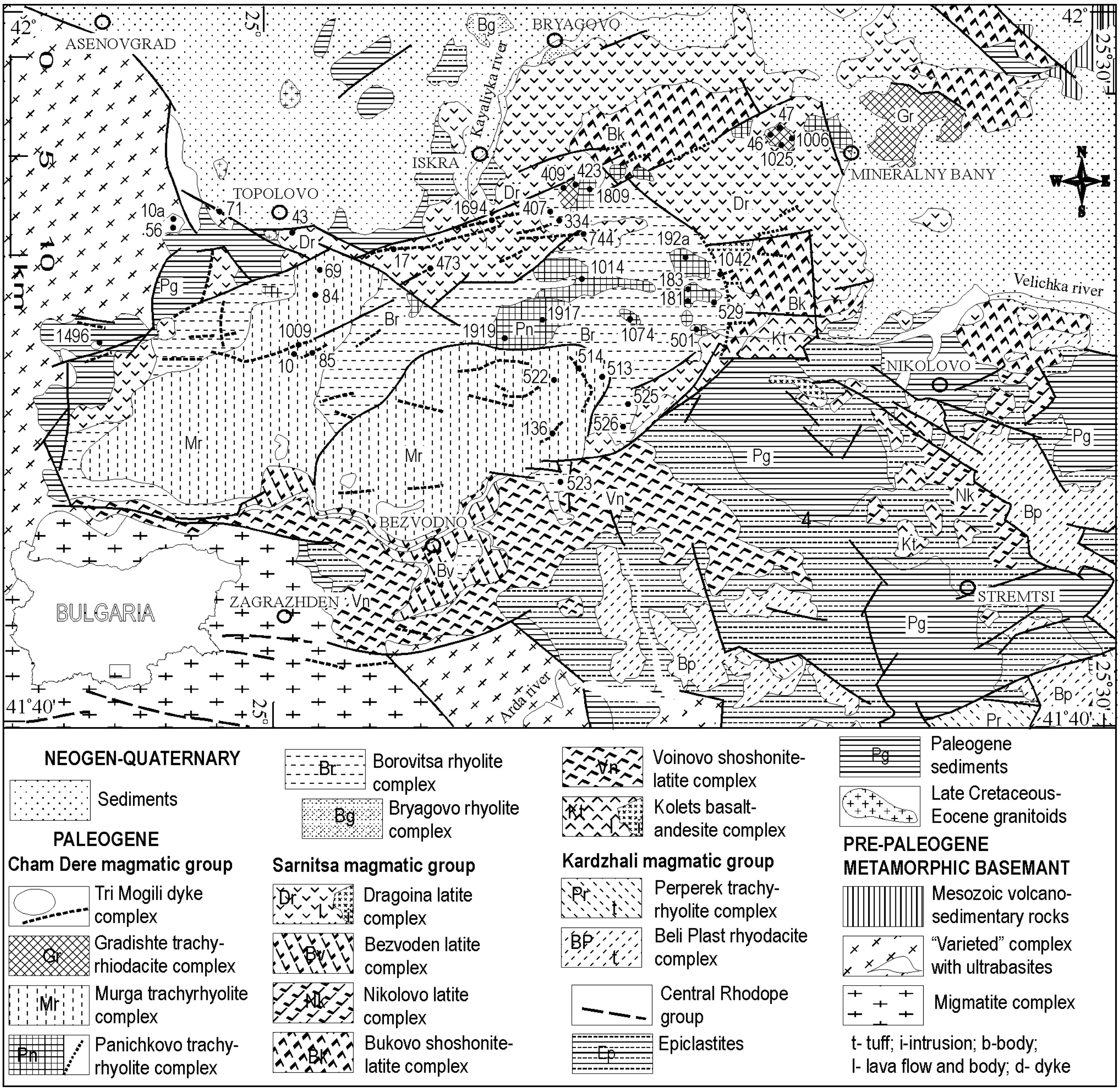

Fig. 1. Map of magmatic complexes in the Northeastern Rhodope Depression

the group of acidic rocks – dacites, rhyodacites, and rhyolites. The rocks of Tri Mogili complex fall in the groups of both medium acidic and acidic rocks – basaltic andesites, andesite, dacites, and rhyodacites.

The specified magmatic complexes are characterized with similar values of the contents of the principle oxides. Only Tri Mogili complex differs with higher Na_2O contents (Fig. 2), which results in low values of the K_2O/Na_2O ratio. Tri Mogili and Gradishte complexes display also higher values for thje MnO content.

On the K_2O/SiO_2 diagram (Fig. 3) the analyses for the majority of the acidic varieties fall in the field of the shoshonite series (trachydacites, trachyrhyodacites, and trachyrhyolites). A significant number of analyses occupy the field of the high-potassium subalkaline series (high-potassium quartztrachytes, trachyrhyodacites, and trachyrhyolites) and only single samples are in the field of the high-potassium calcalkaline series (high-potassium dacites, rhyodacites, rhyolites). The medium acidic varieties of Tri Mogili complex fall predominantly in the field of the high-potassium subalkaline series (high-potassium trachyandesites and trachites) and partially in the field of the shoshonite series (shoshonites and latites).

The rocks under study are characterized also by an increased total alkalinity. The majority of the rocks plotted on the diagram $(Na_2O+K_2O)/SiO_2$ occupy the field of the trachyte varieties (Fig. 4). The rocks of Tri Mogili complex are characterized also by relatively highest alkalinity.

Discussion

The rocks of Borovitsa, Panichkovo, Murgen, and Gradishte complexes are characterized with similar regularities

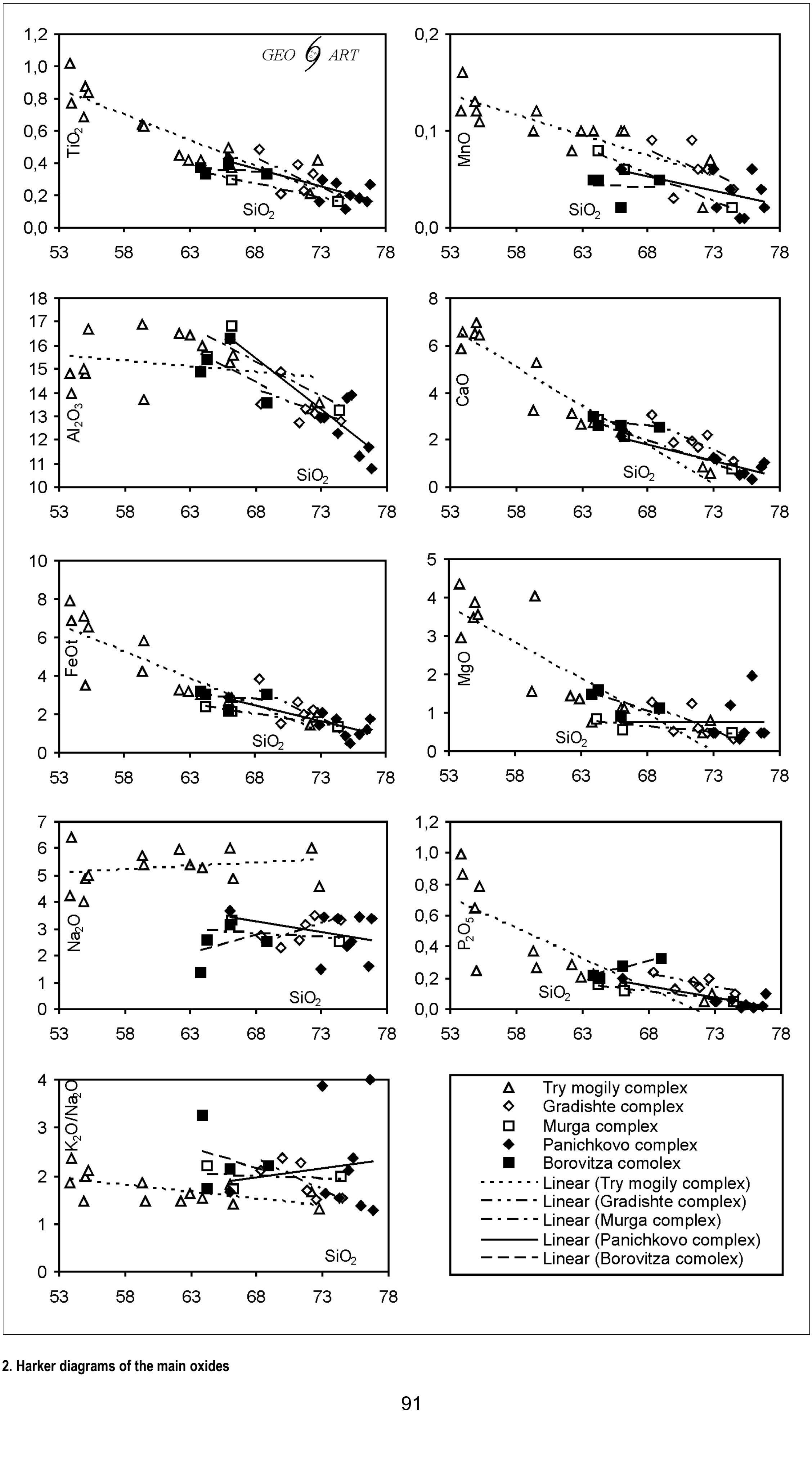

Fig. 2. Harker diagrams of the main oxides

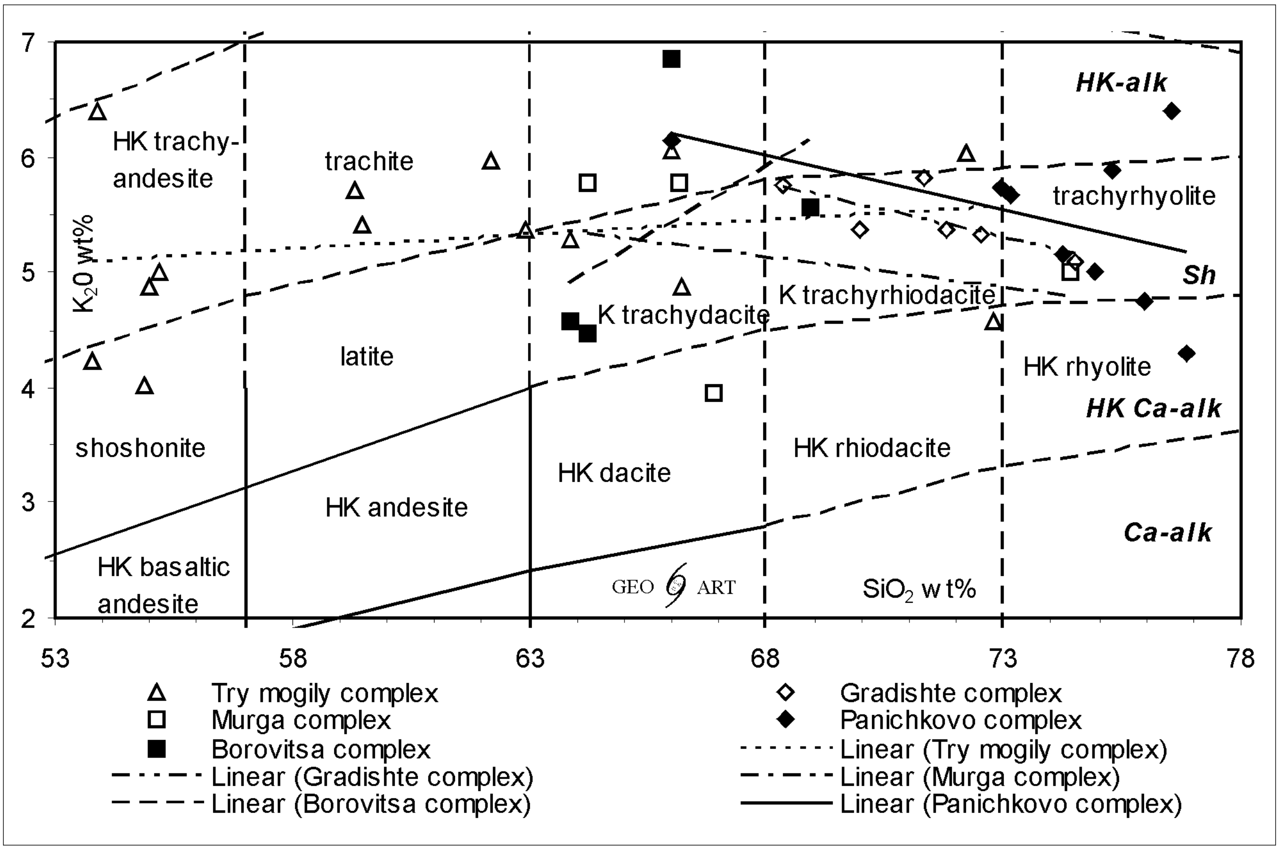

Fig. 3. K_2O/SiO_2 diagram (according Dabovski et al., 1991)

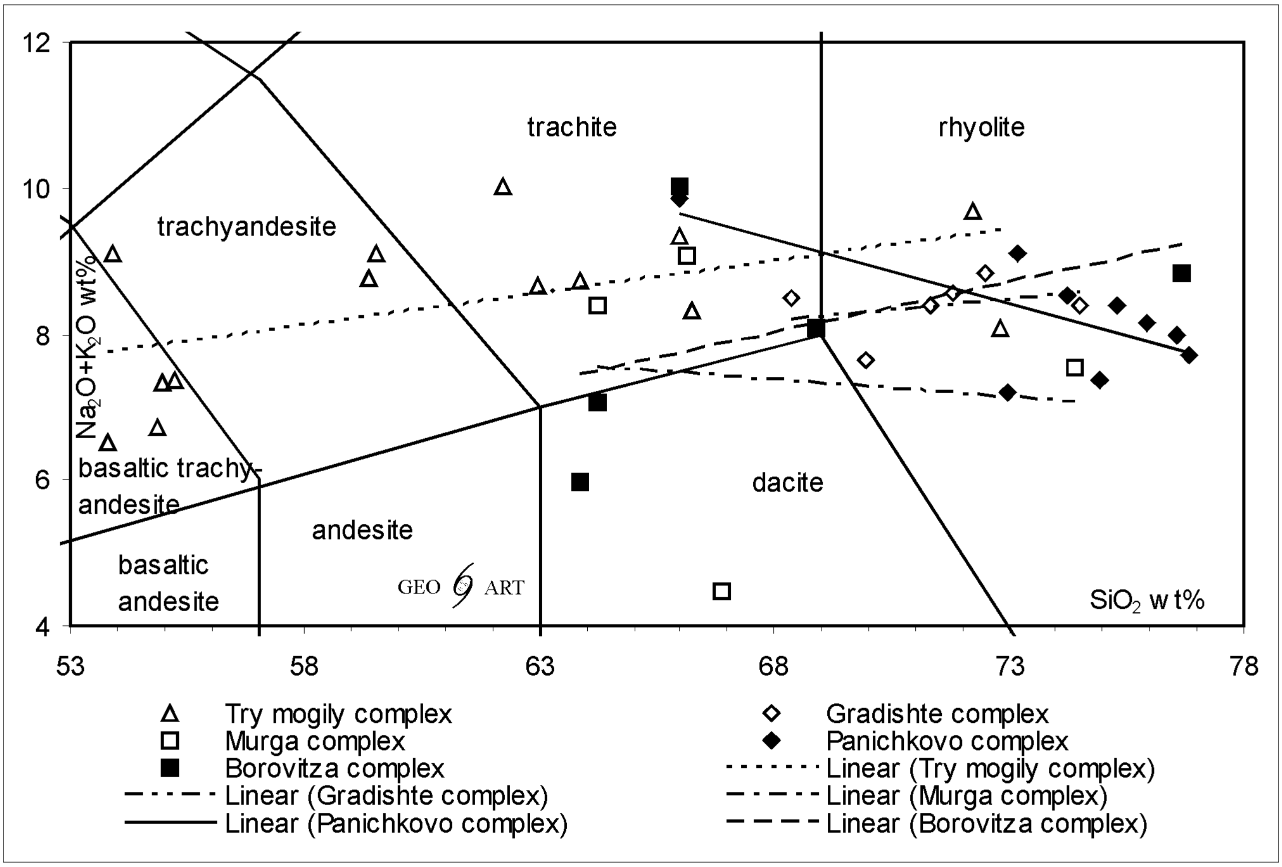

Fig. 4. $(Na_2O+K_2O)/SiO_2$ diagram (according Le Bas et al., 1986)

Table 1
Representative analyses of samples from the Cham Dere group

No	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	FeOt	MnO	CaO	MgO	K_2O	NaO_2	P_2O_5	CO	S	H_2O-	LOI	H_2O+	∑
Try mogily complex																		
136	65,99	0,50	15,30	2,62	0,37	2,75	0,10	2,37	1,11	6,05	3,30	0,17		0,02	0,30	0,98	0,00	99,18
514	53,80	1,02	14,81	6,84	1,72	7,94	0,12	5,87	4,37	4,24	2,28	0,99		1,70	2,00	2,22	0,00	101,98
17a	54,97	0,88	14,80	0,41	3,13	3,50	0,12	6,96	3,88	4,88	2,45	0,25	1,00	0,07	0,69	1,84	0,00	96,33
10	59,33	0,64	16,92	2,93	1,58	4,25	0,10	3,24	1,56	5,72	3,06	0,37	1,76	0,01	0,82		1,72	99,76
1009	62,94	0,42	16,43	2,67	0,75	3,18	0,10	2,69	1,35	5,37	3,31	0,21	0,35	0,01	1,04		2,05	99,69
56	62,20	0,45	16,50	2,63	0,86	3,25	0,08	3,09	1,43	5,96	4,05	0,29	0,45	0,01	1,01	1,05	0,71	100,77
744	59,49	0,63	13,69			5,85	0,12	5,25	4,04	5,42	3,68	0,27				1,37	0,00	99,81
85	63,86	0,42	15,97	2,44	0,78	3,00	0,10	2,74	0,77	5,28	3,44	0,23	1,17	0,01	0,92		1,53	99,66
1416	66,23	0,37	15,57	1,91	1,11	2,85	0,10	2,46	1,10	4,88	3,44	0,14	0,75	0,01	0,75		1,18	100,00
10a	72,80	0,42	13,60	1,84	0,43	2,10	0,07	0,56	0,81	4,58	3,50	0,10			0,77	1,60	0,00	101,08
71	72,21	0,21	13,32			1,43	0,02	0,86	0,50	6,04	3,64	0,05				1,20	0,00	99,48
473	54,87	0,69	15,00	4,81	2,73	7,11	0,13	6,52	3,48	4,01	2,70	0,65	2,70	0,13	0,10		1,59	100,11
43	55,20	0,84	16,70	3,66	3,20	6,53	0,11	6,46	3,56	5,00	2,37	0,79	0,32	0,02	0,49		1,23	99,95
1694	53,89	0,77	13,98	6,05	1,38	6,89	0,16	6,58	2,95	6,40	2,70	0,87	1,80	0,02	0,30		1,98	99,83
Gradishte complex																		
409	74,50	0,18	12,82	1,29	0,12	1,29	0,04	1,13	0,31	5,09	3,31	0,10	0,22	0,01	0,10	0,80	0,59	100,61
423	71,80	0,23	13,30	1,69	0,44	1,98	0,06	1,66	0,62	5,37	3,18	0,14	0,02	0,21	0,21		1,18	100,11
1014	69,96	0,21	14,90	1,43	0,25	1,55	0,03	1,89	0,52	5,37	2,28	0,13	0,09	0,01	0,85	1,87	0,50	100,29
47	68,36	0,49	13,50			3,86	0,09	3,07	1,28	5,75	2,73	0,24				0,98	0,00	100,35
48	71,32	0,39	12,75			2,63	0,09	1,93	1,26	5,82	2,56	0,18				1,34	0,00	100,27
1025	72,50	0,33	13,14			2,28	0,06	2,18	0,50	5,32	3,52	0,20				0,66	0,00	100,69
Murga complex																		
513	74,38	0,16	13,26	1,37	0,14	1,39	0,02	0,75	0,47	5,00	2,53	0,05	0,04	0,01	0,65	0,93	0,96	100,72
522	66,90	0,18	14,20	1,22	0,18	1,29	0,08	2,24	0,82	3,96	0,52	0,01		0,01	4,50		4,90	99,72
69	66,16	0,30	16,83	1,61	0,68	2,15	0,06	2,12	0,55	5,77	3,31	0,12	0,50	0,01	0,26		1,55	99,83
84	64,21	0,33	15,50	2,39	0,25	2,42	0,08	2,85	0,85	5,77	2,61	0,16	1,40	0,01	1,84	2,82	0,00	101,07
Panichkovo complex																		
1917	72,96	0,16	12,95			1,46	0,06	1,22	0,50	5,73	1,48	0,05				3,00	0,00	99,57
1919	76,55	0,16	11,66			1,20	0,04	0,85	0,50	6,40	1,60	0,02				1,18	0,00	100,16
1809	75,30	0,20	13,88			0,50	0,01	0,60	0,50	5,89	2,50	0,03				0,88	0,00	100,29
1042	66,00	0,43	16,26	2,00	1,04	2,86	0,06	2,17	0,84	6,15	3,69	0,20	0,09	0,15	0,24		1,24	100,56
181	74,23	0,28	12,25			1,78	0,04		1,20	5,16	3,36	0,06				0,49	0,00	100,15
183	76,84	0,27	10,80			1,78	0,02	1,05	0,50	4,30	3,40	0,10				0,88	0,00	99,94
192A	73,16	0,30	12,93			2,10	0,02	1,16	0,50	5,66	3,44	0,05				0,74	0,00	100,06
529	74,93	0,11	13,75	0,90	0,07	0,89	0,01	0,54	0,31	5,00	2,37	0,01		0,01	0,28		1,60	99,89
1006	75,94	0,18	11,31			0,97	0,06	0,32	1,97	4,74	3,43	0,01				0,57	0,00	99,50
Borovitza complex																		
334	68,90	0,33	13,59	2,42	0,80	3,00	0,05	2,56	1,10	5,57	2,53	0,32	0,02	0,01	0,30		1,30	99,80
407	76,70	0,15	11,20	0,55	0,28	0,78	0,02	0,70	0,32	8,32	0,52	0,08	0,02	0,01	0,10		0,93	99,90
523	66,00	0,39	16,30	1,97	0,33	2,12	0,02	2,60	0,94	6,86	3,18	0,28	0,04	0,02	0,38		0,60	99,91
525	63,85	0,37	14,86	3,10	0,40	3,22	0,05	2,97	1,50	4,57	1,40	0,22		0,02	2,43	0,00	4,10	99,84
526	64,24	0,33	15,39	2,58	0,68	3,03	0,05	2,61	1,59	4,47	2,61	0,20		0,01	1,68	0,00	3,20	99,64

in the distribution of the major oxides. This supports the idea about common source (magma chamber) of the initial magma. The trends of distribution on the K_2O/SiO_2 dispose mainly in the field of the shoshonite series.

Tri Mogili complex is characterized with higher values for potassium and even more higher ones for sodium. In the case of the more basic varieties the distribution trend of potassium on the diagram falls in the field of the high-potassium subalkaline series. This complex is characterized with highest total alkalinity in comparison with the rest dyke complexes and all volcanic magmatic complexes from the late extensional stage of Eastern Rhodopes (Georgiev, Milovanov, 2003, 2004; Георгиев, Милованов, 2005).

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