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Research Article

MINERAL RAW MATERIAL RESOURCES FOR PRODUCING BASALT FIBERS ON WEST AND SOUTH OF UZBEKISTAN AND PROSPECTS OF THEIR INDUSTRIAL USE

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ABSTRACT
The article provides information on the basalt formations studies' results in the territory of Western and Southern Uzbekistan. The article reviews suitability of raw materials for the production of basalt fiber, also studies the chemical composition of the rock, the mineral and petrographic composition and parameters of the melting processes.

Keywords*: Basalt, Gabbro, Mineral Fiber, Acidity Modulus, Manifestation, Deposit, Western and Southern Uzbekistan*

INTRODUCTION
On the territory of Western and Southern Uzbekistan within the Tien-Shan folded system, there is found a large number of different age of magmatic formations of the gabbro-basalt group. Complex processes of basitic rocks formation are expressed in the variability of their composition and structure, not only in different arrays, but also within a single magmatic body. Therefore, despite the wide prevalence of the main magmatism within the region, the question of the possibility of using basalt raw materials for the production of basalt fibers can be solved.
Many Researchers made a great contribution in the study of the geological structure, hydrogeology, developmental conditions and determination of prospects of magmatic formations of the Uzbekistan as raw materials for mineral fibers and mineral wool production (Khamidov, 2005; Khakberdiev *et al.*, 2017; and Shin *et al.*, 2014).

MATERIALS AND METHODS
Representative samples for studies using silicate analysis were selected from the samples taken, which were previously crushed to 1.0 mm and reduced to an analytical sample of 100-150 g. On the basis of the ratio of the sum of Si and Al oxides to the sum of Ca and Mg oxides, the values of the acidity of the studied objects were determined.

RESULTS AND DISCUSSION
The rocks of the studied objects are mainly basalts, diabases and gabbroids. The generalized indicators of the material composition of the studied objects according to the silicate analysis are presented in the Table 1. The SiO_2 content varies in the range of 41.0-51 and 56 %, the lowest content characteristic of basalt occurrences of Bukantau, Vuary diabase occurrences. The amount of alkalis varies between 0.45-5.76.
In Central KyzylKums there are 19 promising objects which are represented by basalt, diabase and gabbro. Intrusive rocks having hybrid character (gabbro-syenites, gabbro-diorites, monzonites of diorite, etc.), as a rule, are unsuitable for the production of stone casting and mineral wool. Out of the total number of objects, the basalt of Karatosh porphyrite deposit was studied in detail. Basalt porphyry according to its quality characteristics meet the requirements of the industry and can be used to produce staple super thin fibers. Laboratory and technological studies have shown that this is possible without the addition of other raw materials.
Chemical and technological studies have found that the productive thickness of the Karatosh deposit, in addition to basalt superfine fiber, is suitable for the production of mineral wool and stone casting.

According to chemical and petrographic compositions, useful thickness suitable for the production of mineral fiber and mineral wool was found in basalts of Western and Eastern Auminzatau, Kulkuduk, Baymen and Kynyr.

Table 1: Chemical composition of the studied objects

S.№	The content of the components in %										Ms**
	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	FeO	CaO	MgO	K_2O	Na_2O	ППП*	
1	43.0-51.0	11.0-17.0	0.2-1.6	10.0-18.0		8.0-13.0	4.0-12.0	2.0-5.0		3.0	3.25
2	46.0-52.0	13.0-18.0	0.5-2.5	8.0-15.0		6.5-11.0	3.5-10.0	2.0-6.0		5.0	4.2
3	47.5-52.5	14.0-18.0	0.2-2.0	7.0-13.5		8.0-11.0	3.5-8.5	2.5-6.0		4.0	4.3
4	51.56	14.91	0.78	10-18.0		7.08	5.90	0.58	4.47	3.37	5.12
5	44.38-47.18	10.43-13.96	0.10-0.30	7.98-13.4		5.53-15.42	1.2-7.96	0.45-1.35	2.42-4.0	8.85-18.85	3.9
6	49.08	19.78	0.62	9.76		9.64	3.17	0.65	3.98	-	5.73
7	48.11	15.36	1.80	12.17		11.25	7.63	0.30	2.42	0.80	3.36
8	45.82	15.06	1.34	9.57		7.82	7.72	1.09	2.67	7.43	3.93
9	47.82	15.89	1.73	10.08		9.27	5.70	0.65	3.46	5.52	4.25
10	46.46	12.58	2.60	10.38		14.40	5.54	0.90	4.43	3.56	2.96
11	49.66	14.58	1.36	13.1		7.69	7.41	0.28	2.80	3.23	4.25
12	52.18	16.28	0.73	11.04		7.54	4.43	0.72	4.01	3.74	5.72
13	41.00	12.73	1.96	12.33		11.83	4.89	0.71	2.74	8.45	3.21
14	48.54	14.40	2.14	11.65		9.88	7.18	3.99		2.36	3.68
15	51.24	18.0	1.0	6.40		7.07	7.06	5.05		4.68	4.9
16	49.1	14.48	1.27	9.33		13.2	7.5	2.55		1.55	3.1
17	49.66	17.44	1.46	9.16		8.96	5.52	5.05		1.10	4.6
18	44.54	5.66	2.62	11.28		9.73	14.57	3.91		7.34	2.1
19	44.86	5.63	2.72	11.33		9.64	13.75	3.85		7.4	2.2
20	43.65	13.88	2.33	12.4		8.71	6.69	3.97		5.36	3.7
21	44.16	14.38	2.39	11.85		9.10	6.74	3.97		4.99	3.7
22	47.58	14.03	2.63	12.30		10.12	5.52	0.89	3.57	3.27	3.9
23	50.1	10.3	3.15	13.21		7.68	6.36	3.02		5.13	4.3
24	47.31	12.69	3.84	11.81		8.37	5.23	3.41		6.38	3.7
25	46.49	15.13	1.9	9.43		5.46	6.44	4.61		3.77	5.2
26	43.95	14.18	2.36	12.0		9.10	6.64	4.17		7.30	3.7
27	44.84-56.76	12.0-20.0	2.4-3.2	3.0-10.8		3.91-23.78	1.92-11.36	3.61-4.49		3.60-9.04	3.5
28	47.20	21.40	1.2	7.20		8.73	6.82	2.89		4.44	4.4

Note: Ms – The module of acidity (relation $SiO_2+Al_2O_3/CaO+MgO$). 1. Requirements for raw materials for staple fiber production; 2. Requirements for raw materials for the production of staple super-thin fibers; 3. Requirements to raw materials for the production of continuous fibers; Deposit, occurrences: 4. Balantau-1; 5. Tashbulak; 6. Tamditau-2; 7. Western Auminzatau; 8. East Auminzatau; 9. Kulkuduk; 10. Baymen; 11. Kynyr; 12. Zaravshan; 13. Dzhetymtau; 14. Karatosh; 15. Agalyk; 16. Aktash; 17. Takhtakaracha; 18. Arvaten; 19. Karakiya; 20. Asmansay-1; 21. Kargalyk; 22. Central Asmansay; 23. Uzunbulak-1; 24. Uzunbulak-2; 25. Chimkurgan; 26. Yangikishlak; 27. Vuary; 28. Badava.

Laboratory and technological studies carried out in 1989, defined the suitability of basaltoids of these occurrences for various types of basalt fiber materials. The basalts of Kulkuduk are suitable for rough, super-thin and thin staple fibers and also the occurrences of Kynyr-coarse and super-thin fibers useful for

construction purposes. Basalts and diabases of the Western and Eastern Auminzatau, as well as in the Baymen – thin staple fibers. In the diabases of the Eastern Auminzatau CaO was 1% less than TC (technical conditions) (Khamidov 2005).

Some minor deviations from the normalized values in either direction are not decisive, since the composition of the melt rocks can be enriched by adding a sub-charge material containing the missing components

According to chemical analysis of useful thickness of Western and Eastern Auminzatau occurrences, the diabases in composition, homogeneity meet the technical requirements for the raw materials for the production of composite materials. Given the low viscosity and crystallization ability, as well as the conditions of fiber formation, these diabases can serve as a raw material for the production of thin staple fibers. The technology of production of diabase, the Western Auminzatau does not require feeders of precious metals, which greatly reduces the production cost of fiber. On the basis of laboratory and technological studies of basalt occurrences of Kulkuduk their suitability for the production of coarse, super-thin and thin staple fibers can be seen. According to their technological properties, they are not inferior to the basalt of the Berestovetsky Deposit of Ukraine used as raw materials. This explains the convergence of the absolute values of viscosity at high temperatures (Table 2). Within North Tamdytau selected three promising signs: Kynyr, Balpantau and Zarafshan. The results of laboratory-technological researches defined that the Kynyr basalts can be recommended to obtain a coarse and superfine fiber for construction purposes. Ordinary samples of the occurrences of Balantau-1 and Zarafshan conform to the requirements of the 21-SSR-410-86, however, the results of technological research, despite the homogeneity of the basalts, they are unsuitable due to the high content of silica. Diabases occurrences of Bukantau with respect to chemical and mineral compositions correspond to the requirements for raw materials for the manufacture of mineral wool, and productive series of Tashbulak and Tamdytau 2 (Khodzhaev *et al.*, 2016).

The most common indicator that determines the suitability of raw materials for the production of basalt fiber and its quality is the acidity module Mк:

$$M_s=(SiO_2+Al_2O_3/CaO+MgO)$$

where SiO_2, Al_2O_3, CaO, MgO – are the content of the corresponding oxides in the raw material or melt, mass %

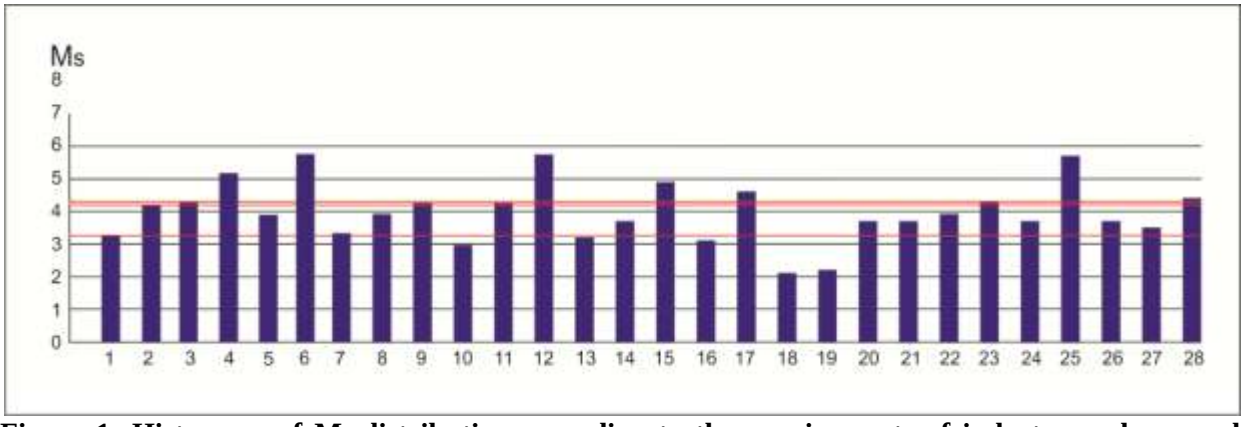

Figure 1: Histogram of M_s distribution according to the requirements of industry and research objects. Note (see Table 1)

However, the approved value of minerals in raw materials for the production of different types of basalt products does not meet GOST 4640-93 "Mineral wool" (National Standard requirement) because the lower limit is defined at the level of not less than 1.2-1.6 (Dzhigiris and Makhova 2002). According to the published data, M_s with a value of at least 1.5-1.8 to 4 is recommended for single-component charge. The

recommended range of values for the production of continuous fibers is 4.7 to 6.5. Developers of Ukraine and Georgia recommend value, of which, according to the published results of the chemical composition are within the range of 3.18-5.56 (average 4.11) and 3.15-6.1 (average 4.3), respectively.
Therefore, taking into account the above-published data of the M_s raw materials for the production of various types of products from basalt raw materials is in the range from 3.15 to 6.15. The figure in graphical form shows the indicators of the M_s and its values on the studied objects of Western and Southern Uzbekistan.

Table 2: Temperature dependence of rock viscosity of Central Kyzyl Kum and Berestovitsky deposit occurrences (according to Gorbachev G. F., 1989.)

№	The name of the object	The viscosity of Ep C at t C					TV.P K C
		1450	1400	1350	1300	1250	
1	Baymen occurrences	16	26	46	83	148	1230
2	Kulkukduk occurrences	38	66	115	210	400	1270
3	Kynyr occurrences occurrences	59	100	170	300	580	1270
4	Western Auminzatau occurrences	22	40	66	129	240	1260
5	East Auminzatau occurrences	26	46	75	140	265	1270
6	Berestovetskoye deposit (Ukraine) occurrences	36	62	102	182	354	1275

In Nuratau, Zirabulak, Karatyube and Malguzars the mountains have large number of occurrences of the basic rocks, represented by diabase, the cut-diabase, gabbro-diabase and diabase middlemanning. This is primarily Asmansay deposit (3 phase), Chimkurgan (East site) and a number of occurrences. From the past to the most promising related Aktash, Arvaten, Karakiya, Uzunbulak-I, Uzunbulak-II, Karakchitau, Chimkurgan, Yangikishlak, Agalyk and Tahtakaracha.
Asmansay deposit is located in the band of basic rocks of the Shavaz suite (diabase, spilite-diabases, diabases almond stone) with a length of 20 km and width of up to 1.5 km in the Central part. Within the deposit in different years it was explored Asmansay-I, Kargalyk and Asmansay Central areas with the calculation of industrial reserves for their use as mineral fiber. In its natural form, the basalts of all three sections are suitable for the production of almost all types of basalt fiber. As can be seen from Table 3, the basalt of Asmansay deposit is close to the basalts of the Berestovetskoy deposit by its absolute viscosity values at high temperatures, and at low temperatures the beginning of their crystallization is slightly lower. Temperature interval of development of fibers in the range of about 180-200^o (Shin *et al.*, 2014).

Table 3: Temperature dependence of viscosity of rocks field Asmani and Berestovitsa (Repko, 1999)

№	The name of the object	Viscosity values t					TB
		1450	1400	1350	1300	1250	
1	Asmansay deposit	38	58	100	176	348	1250
2	Berestovetskoy deposit (Ukraine)	36	62	102	182	354	1275

Chimkurgan deposit diabase (East site), is located in the strip of basic rocks upstream of Chimkurgan depodit (dolerite, aphyric dolerite, basalts almond stone). To assess the suitability of the main Intrusive rocks for the production of mineral wool in 2014, the properties of diabases of the Chimkurgan deposit were tested and studied. In comparison to the diabases of the well-known deposit in Russia, the Solikamsk Chimkurgan diabases have some superiority in individual components, which makes them qualitatively superior for the production of mineral wool.

The territory of the Southwestern spurs of the Hissar ridge is characterized by a smaller distribution of magmatic formations of the main composition. Badava basalt area is associated with sub volcanic formations Hodzhyrbulak complex of middle devonian and Low Permian Kairak area.
Petrographic analysis of Badava basalt area selected the following varieties: olivine-trachybasalt, gabbro-diabase, dolerite and subserosal gabbro-diabase-trachybasalt (Khakberdiev, 2017).
These data (Table 1) show that the basalts of the Badava area meet the chemical composition requirements of the industry as raw materials from the mining industry for the production of staple fiber, staple super-thin fiber and continuous fiber.
In case of confirmation of the prospects of the experimental-technological way of the South-Western spur of the Hissar range can become a raw material base for industrial production of stone raw materials in the South of the Republic. This is facilitated by favorable economic, mining, geological and transport conditions.
Diabases occurrences differ constantly of mineralogical and petrographic and chemical compositions. Therefore, some samples meet the necessary requirements of the specifications, while others do not meet those. In addition, the reduced content of CaO, MgO, Fe_2O_3, contributes to the deterioration of the crystallization properties of the melt (Khamidov 2011).

Conclusion

Mineral resources of Uzbekistan are currently serving the Karatash and Asmantay oil field. Potentially promising as a feedstock for production of basalt fibers for various purposes of suitability of rocks in Central Kyzyl-Kum are Kynyr, Baymen, Kulkuduk, Western and Eastern, Auminzatau, Nurata, Zirbulak, Karatyube and Malguzars mountains (Aktash, Karakiya, Arvaten and Uzunbulak), in the South-Western spurs of the Gissar range (Badava).

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