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**“DAUTOSH” KONI MENIRALINI LAZERLI DIFRAKSIYA USULIDA TEKSHIRISH VA TARKIBINI O‘RGANISH****ИССЛЕДОВАНИЕ И ИЗУЧЕНИЕ СОСТАВА МИНЕРАЛА МЕСТОРОЖДЕНИЯ «ДАУТОШ» МЕТОДОМ ЛАЗЕРНОЙ ДИФРАКЦИИ****STUDYING AND ANALYZING THE COMPOSITION OF THE MINERAL FROM THE “DAUTOSH” DEPOSIT USING THE LASER DIFFRACTION METHOD****<sup>1</sup>Qaxxorov Navruzбек Toyir o‘g‘li** <sup>1</sup>Qarshi davlat texnika universiteti, “Sanoat muhandisligi” kafedrasida katta o‘qituvchisi, Shaxrisabz, O‘zbekiston**<sup>2</sup>Jo‘rayev Ruzimurod Sattorovich** <sup>2</sup>Qarshi davlat texnika universiteti, “Sanoat muhandisligi” kafedrasida katta o‘qituvchisi, Shaxrisabz, O‘zbekiston**<sup>3</sup>Mardonov O‘ktam Mardonovich** <sup>3</sup>Buxoro Davlat universiteti, “Kimyo va neftgaz texnologiyalari” kafedrasida dotsenti**Annotatsiya**

Mazkur tadqiqotning maqsadi O‘zbekiston janubidagi “Dautosh” konidan olingan mineral namunaning tarkibini o‘rganish va uni mineral o‘g‘itlar ishlab chiqarish manbasi sifatida baholashdan iborat. Tadqiqotda lazerli diffraksiya usuli qo‘llanildi va zarracha o‘lchami, hajm taqsimoti va tarkibiy elementlar aniqlab chiqildi. Tadqiqot natijalariga ko‘ra, o‘rtacha zarracha o‘lchami 5,61 mkm bo‘lib, asosiy tarkibiy qismlar marganets (75,02%), kalsiy (12,53%), temir (5,81%) va kremniy (5,32%) ekanligi aniqlandi. Tadqiqotda mineralning ekologik xavfsizligi ham baholandi. Xulosa qilib aytilishicha, ushbu mineral asosida marganetsli o‘g‘itlar ishlab chiqarish O‘zbekiston kimyo sanoatida yangi tarmoq yaratishga xizmat qilishi va qishloq xo‘jaligida hosildorlikni oshirish imkonini berishi mumkin.

**Аннотация**

Цель данного исследования заключается в изучении состава минерального образца, взятого из месторождения «Даутош» на юге Узбекистана, и оценке его пригодности в качестве источника минеральных удобрений. В исследовании применён метод лазерной дифракции для определения размер частиц, распределения по объёму и состава элементов. Результаты показали, что средний размер частиц составляет 5,61 мкм, а основными компонентами являются марганец (75,02%), кальций (12,53%), железо (5,81%) и кремний (5,32%). Также проведена оценка экологической безопасности минерала. В заключение отмечено, что использование данного минерала для производства марганцевых удобрений может способствовать созданию нового сектора химической промышленности в Узбекистане и повысить урожайность в сельском хозяйстве.

**Abstract**

The purpose of this study is to investigate the composition of a mineral sample from the “Dautosh” deposit located in southern Uzbekistan and to evaluate its potential as a source of mineral fertilizers. The research employed the laser diffraction method to determine particle size, volume distribution, and elemental composition. The findings revealed that the average particle size is 5.61  $\mu\text{m}$ , with manganese (75.02%), calcium (12.53%), iron (5.81%), and silicon (5.32%) as the primary components. The environmental safety of the mineral was also assessed. It is concluded that the use of this mineral for producing manganese-based fertilizers could contribute to the establishment of a new chemical industry sector in Uzbekistan and enhance agricultural productivity.

**Kalit so‘zlar:** mineral o‘g‘itlar, lazerli defraksiya, mineral, xomashyo, marganesli og‘itlar, funksional xususiyatlari.

**Ключевые слова:** Минеральные удобрения, лазерная дифракция, минерал, сырье, марганцевые удобрения, функциональные свойства.

**Key words:** mineral fertilizers, laser diffraction, mineral, raw material, manganese-based fertilizers, functional properties.

## KIRISH

O'simliklarning hosildorligi yaxshilanishi uchun, birinchi navbatda, mineral azotli [1] va fosforli o'g'itlar [2] bo'lishi hisoblanadi, shuning uchun bu o'g'itlarni ishlab chiqarish yaxshi yo'lga qo'yilgan. Mineral o'g'itlar muhim oziq moddalar bilan bir qatorda ma'lum miqdorda og'ir metallarni (As, Cd, Hg va Pb) ya'ni mikroelementlarni (Co, Cr, Cu, Mo, Mn, Ni va Zn) ham o'z ichiga oladi [3-6] va bunday o'g'itlarni uzoq muddat qo'llash tuproqda [7] va ekinlarda [8] metallarning sezilarli darajada to'planishiga olib kelishi mumkinligini hisobga olgan holda o'z o'rnida ishlatish kerak. Og'ir metallar o'g'it ishlab chiqarish uchun ishlatiladigan xom ashyo tarkibida tabiiy ravishda paydo bo'ladi. Mana shu manbalarni aniqlash va uning tarkibini o'rganish usullarini aniqlash juda muhim hisoblanadi[9].

Ko'pincha qattiq minerallar tarkibidagi og'ir metallar atom absorbsion spektroskopiya yordamida, kislotali parchalanishi bilan aniqlanadi. Masalan, turli qattiq azotli va fosforli mineral o'g'itlardagi Cd, Cu, Cr, Co, Mn, Ni, Pb va Zn ning miqdori AAS (atom absorbsion spektrometriyasi) usuli yordamida aniqlangan [4,6,10-15], ammo GF-AAS (metall izlarini aniqlash uchun ishlatiladigan yuqori sezgir spektroskopik analiz uskunasi) kabi boshqa usullar ham qo'llanilgan [16]. Shuningdek, ICP-MS (induksiyalangan plazmali mass-spektrometriya) ham ko'p amaliyotlarda qo'llaniladi [17-19].

**So'nggi paytlarda quyidagi usullar, qattiq minerallar tarkibidagi metallarni tahlil qilish usullari ko'proq qo'llanilmoqda, ular namunaning kislotali preparatini o'z ichiga olmaydi.** Ulardan biri y-nurli spektrometriya (GRS) bilan birgalikda neytron faollashuv tahlili (NAA) [20], yana biri esa rentgen-fluoresans spektroskopiyasi (XRF) [21,22]. So'nggi yigirma yil ichida taraqqiyot bo'ldi XRF usulida ishlab chiqarilgan bo'lib, u laboratoriyaning mustaqil qurilmalaridan portativ va yengil asboblarga aylandi. Portativ XRF (pXRF) spektrometrlari deb ataladigan ushbu portativ asboblarda qishloq xo'jaligi olimlariga materiallarni (tuproq, o'simlik materiallari va o'g'itlar) har qachongidan ham ko'proq moslashuvchanlik bilan tadqiq qilish imkonini berdi [23]. Usul tez, aniq va buzilmaydigan, ammo namunani tayyorlash odatda murakkab yoki ko'p vaqt talab qilmaydi [24]. Minerallar tarkibidagi metall tarkibini bilish turli xil xavflarni baholash tadqiqotlariga hissa qo'shishi mumkin, shuningdek, tuproqning tarkibini ham (As, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Si, Sr, Th, U, Zn, Zr va Y) aniqlash mumkin [25-37].

Mineral resurslar kimyo sanoat va qishloq xo'jaligi rivojlanishini asosiy vositasi hisoblanadi, jumladan o'g'itlar, qurilish materiallar va sanoat tarmoqlari uchun xom ashyo sifatida xizmat qiladi. Ushbu resurslardan samarali foydalanish ularning tarkibi, tuzilishi va funktsional xususiyatlarini har tomonlama tushunishni talab qiladi. Shu nuqtai nazardan, zamonaviy tahlil usullari foydali qazilmalarni aniq tavsiflash uchun ajralmas bo'lib qoldi, bu tadqiqotchilarga ekologik muammolarni hal qilishda ularning potentsial qo'llanilishini o'rganish imkonini beradi.

Ushbu tadqiqot O'zbekistonning janubiy mintaqasida joylashgan va yangi mineral o'g'itlarni o'zlashtirish uchun katta imkoniyatlarga ega "Dautosh" konining mineral resurslariga e'tibor qaratilgan. Lazerli diffraksiya usulini qo'llash orqali mineralning zarracha o'lchamlari va tarkibiy xususiyatlari tahlil qilindi. Lazer diffraksiyasi aniqligi, tezligi va zarracha o'lchamlarini batafsil taqsimlash qobiliyati tufayli nozik zarralarni tavsiflash uchun keng qo'llaniladigan usuldur.

Tadqiqot mineralning funktsional xususiyatlarini baholash va uning atrof-muhitga ta'sirini baholash, marganets asosidagi o'g'itlar ishlab chiqarishda foydalanish uchun yo'l ochishga qaratilgan. Bunday o'g'itlar o'simliklarning o'sishini kuchaytirish uchun zarur bo'lib, O'zbekiston kimyo sanoatining yangi tarmog'ining rivojlanishiga hissa qo'shishi mumkin. Ushbu maqolada "Dautosh" koni mineralining zarracha o'lchamlari va kimyoviy tarkibini aniqlash uchun qo'llangan analiz usullari bayon qilinadi, olingan natijalar batafsil tahlil qilinadi hamda ushbu xususiyatlarning marganetsga boy o'g'itlar ishlab chiqarishdagi amaliy ahamiyati asoslab beriladi.

**Ushbu tadqiqotning maqsadi** — O'zbekistonning janubiy hududida joylashgan "Dautosh" konidan olingan marganesli mineral ruda namunalarining fizik-kimyoviy xususiyatlarini lazerli diffraksiya va elementar tahlil usullari yordamida aniqlash, ularning zarracha o'lchamlari, hajmiy taqsimoti, elementar va oksid tarkibini baholash hamda mazkur mineralning ekologik xavfsizligi va texnologik yaroqliligini aniqlashdan iborat. Tadqiqot natijalariga asoslanib, mineralning marganetsga boy o'g'itlar ishlab chiqarish uchun istiqbolli xom ashyo sifatidagi imkoniyatlarini

aniqlash, shuningdek uning qishloq xo'jaligi va kimyo sanoatidagi qo'llanish istiqbollarini ilmiy asoslash ko'zda tutiladi.

#### **Tadqiqot usullari**

**"Dautosh" koni haqida ma'lumot.** Dautosh marganes konining geologic tuzilishida karbon yotqiziqlari (kvars, oxak va marganes ma'dani) va to'rtlamchi davr yotqiziqlari ishtirok etadi. Ma'danli qatlam oxaktosh, kremniyli, qumli oxaktoshlardan iborat bo'lib, ularning orasida marganes ma'dan tanachalari uchraydi va ular bir-biri bilan ketma-ket joylashgan bo'lib, yagona ma'danga boy to'plamni hosil qiladi. Ma'danli qatlamning 10-60 m bo'lib. Ma'dan tanachalarining qalinligi 0,4 dan 6 metrgacha ekanligi aniqlandi.

**Analiz usuli.** "Dautosh" konidan olingan qattiq mineral namunalari lazerli diffraksiya usuli yordamida lazerli zarracha o'lchamlarini taqsimlash analizatori (Laser Particle Size Distribution Instrument) qurilmasida (Yaponiya, Shimadzu, EDX-8000) o'rganildi (1-rasm). Ushbu analizator lazer diffraksiyasi prinsipiga asoslanadi. Lazer nuri zarrachalarga tushirilganda, zarrachalar lazer nurini ma'lum bir burchakka tarqatadi (diffraksiya). Zarrachalarning hajmi va shakliga qarab diffraksiya burchagi va kuchi o'zgaradi. Kichik zarrachalar nurni katta burchaklarga, katta zarrachalar esa kichik burchaklarga tarqatadi. Ushbu diffraksiya ma'lumotlari analizator tomonidan qayd etilib, zarrachalarning o'lchamlarini aniqlash imkonini beradi. Ushbu asbob zarrachalarning hajm taqsimoti haqida batafsil ma'lumot beradi. Bu esa materialning xususiyatlarini yaxshiroq tushunishga yordam beradi, masalan, kukunlar va emulsiyalarning zichligi, suyuqliklar qovushqoqligini yoki kukunning solishtirma sirti maydoni kabi omillarni aniqlash mumkin.



**1-rasm. Lazerli zarrachalar o'lchagich (Laser Particle Size Distribution Instrument) qurilmasi (Yaponiya, Shimadzu, EDX-8000).**

#### **NATIJAR VA MUHOKAMA**

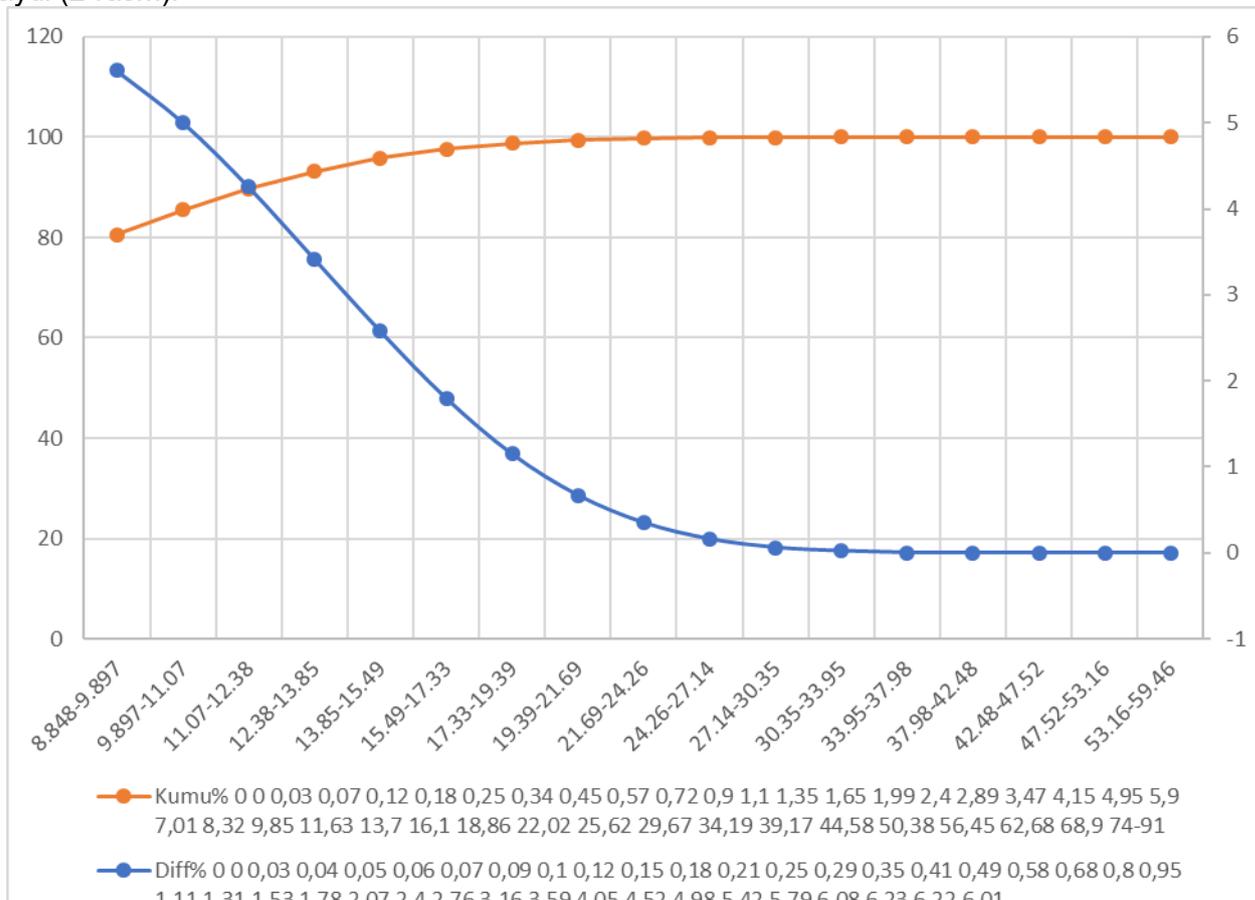
Lazer diffraksiyasi bilan o'lchashda zarrachalarga jismoniy ta'sir qilinmaydi. Bu esa namunani zarar yetkazmasdan o'lchash imkonini beradi. Ushbu asbob zarrachalarning hajm taqsimoti haqida batafsil ma'lumot beradi. Bu esa materialning xususiyatlarini yaxshiroq tushunishga yordam beradi, masalan, kukunlar va emulsiyalarning zichligi, suyuqliklarning qovushqoqligi yoki kukunning solishtirma sirti maydoni kabi omillarni aniqlash mumkin.

Zarracha o'lchamlarini umumlashtiruvchi raqamli qiymatlar quyidagi natijalarni o'z ichiga oladi. O'rtacha o'lcham (D50): 5,61 mkm. O'rtacha hajm diametri (VMD, D[4,3]): 6,48 mkm. O'rtacha sirt diametri (SMD, D[3,2]): 3,20 mkm. Oraliq: 1,928 (tarqatish bir xilligi).

**Hajm taqsimotidan quyidagi natijalar olindi.** Mayda zarrachalar 2–10 mkm o'lchamga ega. Sekin-asta 18-20 mkm ga yaqin kattaroq zarracha o'lchamlarigacha ko'tariladi. Olingan natijalar grafik shaklda tasvirlanadi. Grafikdan shuni bilish mumkinki, hajm taqsimoti egri chizig'i 2-

KIMYO

10 mikron oralig'ida tor taqsimot cho'qqisini aks ettiradi, bu nisbatan bir xil zarracha hajmini tasdiqlaydi (2-rasm).



2-rasm. Tadqiq etilgan "Doutosh" koni marganesli ruda namunasi tarkibidagi zarrachalarning o'lchamlari (disperslik darajasi) bo'yicha fraksiyon taqsimoti grafigi.

Grafik natijalari quyidagi jadvalda to'liq tasvirlangan (1-jadval).

1-jadval. "Doutosh" koni marganesli ruda namunasi tarkibidagi zarrachalarning o'lchamlari (disperslik darajasi) bo'yicha fraksiyon taqsimoti ( tarkibi)

Size(µm)	D iff%	umu %	Size (µm)	iff%	umu %	Size(µm)	iff%	umu%
0.100	0	.00	0.84	.68	.15	7.071	.22	8.90
-0.112	.00	.00	1-0.941	.80	.95	-7.910	.01	4-91
0.112	0	.00	0.94	.95	.90	7.910	.61	0.52
-0.125	.00	.00	1-1.052	.11	.01	-8.848	.01	5.53
0.125	0	.03	1.05	.31	.32	8.848	.26	9.79
-0.140	.03	.03	2-1.177	.53	.85	-9.897	.42	3.21
0.140	0	.07	1.17	.78	1.63	9.897	.58	5.79
-0.157	.04	.07	7-1.317			-11.07		
0.157	0	.12	1.31			11.07		
-0.175	.05	.12	7-1.473			-12.38		
0.175	0	.18	1.47			12.38		
-0.196	.06	.18	3-1.647			-13.85		
0.196	0	.25	1.64			13.85		
-0.219	.07	.25	7-1.843			-15.49		

0.219	0		1.84			15.49		
-0.245	.09	.34	3-2.061	.07	3.70	-17.33	.80	7.59
0.245	0		2.06			17.33		
-0.274	.10	.45	1-2.306	.40	6.10	-19.39	.15	8.74
0.274	0		2.30			19.39		
-0.307	.12	.57	6-2.579	.76	8.86	-21.69	.67	9.41
0.307	0		2.57			21.69		
-0.343	.15	.72	9-2.885	.16	2.02	-24.26	.35	9.76
0.343	0		2.88			24.26		
-0.384	.18	.90	5-3.227	.59	5.62	-27.14	.16	9.92
0.384	0		3.22			27.14		
-0.429	.21	.10	7-3.610	.05	9.67	-30.35	.06	9.98
0.429	0		3.61			30.35		
-0.480	.25	.35	0-4.038	.52	4.19	-33.95	.02	00.00
0.480	0		4.03			33.95		
-0.537	.29	.65	8-4.517	.98	9.17	-37.98	.00	00.00
0.537	0		4.51			37.98		
-0.601	.35	.99	7-5.052	.42	4.58	-42.48	.00	00.00
0.601	0		5.05			42.48		
-0.672	.41	.40	2-5.651	.79	0.38	-47.52	.00	00.00
0.672	0		5.65			47.52		
-0.752	.49	.89	1-6.321	.08	6.45	-53.16	.00	00.00
0.752	0		6.32			53.16		
-0.841	.58	.47	1-7.071	.23	2.68	-59.46	.00	00.00

Zarracha o'Ichami bo'yicha olingan lazerli diffraksiya natijalari mineral tarkibini aniqlash uchun qo'shimcha ravishda elementar tahlil bilan bog'lab baholandi. Elementlarning miqdoriy tarkibi ularning spektral chiziqlar intensivligi (Cps/ $\mu$ A) asosida aniqlanib, eng katta ulushni marganets (MnKa – 3627.8831), undan keyin temir (FeKa – 373.2399), kalsiy (CaKa – 233.9092) va stronsiy (SrKa – 83.4492) tashkil qilishi qayd etildi. Ushbu qiymatlarning umumiy ko'rinishi jadvalda keltirilgan. (2-jadval).

**2-jadval.**

“Doutosh” koni marganesli ruda namunasining kimyoviy elementlar tarkibi va uni aniqlashning analitik spektr parametrlari.

Element	Natija (%)	[3-sigma]	Aniqlangan prat.	Chiziq	Int.(cps/ $\mu$ A)
Mn	75.01 8 %	[0.201 ]	Quan- FP	MnKa	3627.8 831
Ca	12.52 6 %	[0.132 ]	Quan- FP	CaKa	233.90 92
Fe	5.806 %	[0.029 ]	Quan- FP	FeKa	373.23 99
Si	5.320 %	[0.351 ]	Quan- FP	SiKa	2.8303
Sr	0.791 %	[0.013 ]	Quan- FP	SrKa	83.449 2
K	0.279 %	[0.036 ]	Quan- FP	K Ka	3.0516

Taxlil natijalarida shu ko'rsatadiki, ruda tarkibida Si, Rh, K, Ba, Zn va Br kabi elementlar kam tarqalgan. Bu birikmalarning miqdori 3-jadvalda birikma ko'rinishida keltirilgan.

3-jadval.

“Doutosh” koni marganesli ruda namunasining tarkibidagi noruda kimyoviy elementlar oksidlari tarkibi va uni aniqlashning analitik spektr parametrlari.

Element	Natija (%)	[3-sigma]	Aniqlangan prat.	Chiziq	Int.(cps/uA)
$O_3$ $Al_2$	0.731	[0.042]	Quan-EC	AlKa	0.80
$SiO_2$	8.073	[0.135]	Quan-EC	SiKa	18.0
$K_2O$	ND	[0.014]	Quan-EC	K Ka	1.62
$TiO_2$	0.088	[0.006]	Quan-EC	TiKa	1.56
$BaO$	0.179	[0.043]	Quan-FP	BaLa	1.90
$ZnO$	0.047	[0.008]	Quan-FP	ZnKa	2.19
$BrO$	0.034	[0.010]	Quan-FP	BrKa	2.84

### XULOSA

Mazkur tadqiqot O'zbekistonning janubiy hududida joylashgan “Dautosh” konidan olingan mineral tarkibni o'rganishga qaratilgan. Lazerli diffraksiya usuli yordamida mineralning zarracha o'lchamlari va tarkibiy xususiyatlari tahlil qilindi. Natijalar shuni ko'rsatdiki, o'rtacha zarracha o'lchami 5,61 mkm, hajm diametri 6,48 mkm, va sirt diametri 3,20 mkm bo'lib, zarrachalarning asosiy qismi 2–10 mkm oralig'ida tarqalgan. Tarkibiy tahlillar minerallarning 75,02% marganets, 12,53% kalsiy, 5,81% temir va 5,32% kremniydan iborat ekanligi aniqlandi. Ushbu ma'lumotlarga asosanib, marganets asosida o'g'itlar ishlab chiqarish texnologiyasini rivojlantirish rejalashtirilmogda. Bu o'g'itlar o'simliklarning o'sishini yaxshilashda muhim rol o'ynashi mumkin, shuningdek, O'zbekiston kimyo sanoatining yangi tarmog'ini rivojlantirishga xizmat qiladi. Ushbu tadqiqot natijalari ekologik xavfsizlikni ta'minlash va mineral resurslardan samarali foydalanish bo'yicha yangi imkoniyatlarni ochib beradi. Bu, o'z navbatida, qishloq xo'jaligida barqaror rivojlanishga zamin yaratadi.

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