International Journal of Geology, Earth & Environmental Sciences ISSN: 2277-2081
An Open Access, Online International Journal Available at http://www.cibtech.org/jgee.htm
2025 Vol. 15, pp. 73-76/ Nurtayev and Yusupov
Research Article

MINERAL AND CHEMICAL COMPOSITION IN THE OIL SHALES OF THE SANGRUNTAU DEPOSIT

***B. Kh. Nurtayev and Kh. R. Yusupov**
Navoi branch of the Academy of Sciences of the Republic of Uzbekistan,
Navoiy city, Uzbekistan,
**Author for Correspondence: hyusupov768@gmail.com*

ABSTRACT
This article presents information about the forming basins of oil shale deposits, as well as the geological characteristics, mineralogical and chemical composition of the Sangruntau deposit, located in Central Kyzylkum. Such studies were carried out on explored deposits, the ore bodies of which are exposed by drilling and mining workings.

Keywords: *Garoyuchie Slanets, Slanets Basin, Montmorillonite, Kaolinite, Biotite, Gissar Ridge, Tajik Depression*

INTRODUCTION
Paleogene bituminous shales are widely distributed in Uzbekistan. Two shale basins can be distinguished: the Syrdarya and Amu Darya basins. The Syrdarya basin covers the northeastern and central parts of the Kyzylkum Desert, as well as the lower reaches of the Syr Darya River. The Amu Darya basin encompasses the southwestern slopes of the Gissar Range and the Tajik Depression.
The most accessible part of the Kyzylkum bituminous shale basin is the Sangruntau area, located at the southeastern end of the Sangruntau Mountains.
In the inorganic part of this raw material, carbonates and aluminosilicates predominates, with particle sizes usually not exceeding 70 microns. The main rock-forming minerals of this part of the bituminous shale include clay minerals (montmorillonite, kaolinite, biotite), as well as limestone, pyrite, iron hydroxides, and others (Table 1).

MATERIALS AND METHODS
Among the clay minerals in the inorganic part of the bituminous shales in Uzbekistan:
- More than 30% of $Mg_3[Si_4O_{10}]\cdot[OH]_2\cdot[AlFe]_2\cdot[Si_4O_{10}][OH]_2\cdot4H_2O$ – montmorillonite (nanoclay) – a mineral with an unstable chemical composition, largely dependent on the varying water content (12-24%), magnesium oxides (4-9%), aluminum (11-22%), iron (5-10%), potassium, sodium, and calcium up to 3.5%;
- Up to 12% kaolinite $Al_2O_3\cdot2SiO_2\cdot2H_2O$ – a clay mineral from the group of hydrated silicates of aluminum; chemical composition: $Al_4[Si_4O_{10}]$ $(OH)_8$; contains 39.5% Al_2O_3, 46.5% SiO_2, and 14% H_2O;
- Up to 20% biotite $K[Mg,Fe]_3[SiAlO_{10}][OH,F]_2$, a mineral with a variable chemical composition: water 6-11.5%, potassium oxides 4.5-8.5%, magnesium 0.3-28%, iron 0.3-20.5%, aluminum 9.5-31.5%, silicon 33-45%;
- 3-5% sodium $Na_2O\cdot Al_2O_3\cdot6SiO_2$ and potassium-sodium feldspars $K[AlSi_3O_8]$-$Na[AlSi_3O_8]$ – aluminosilicates of various modifications;
- 1-3% apatite $Ca_3(PO_4)_2\cdot Ca(F,Cl)_2$ or $3CaO\cdot P_2O_5$; alongside which there are phosphates: vivianite, bobyerite, carbonate-apatite, duffrenite, lithophilite, monazite;
- 10-25% of oxide compounds of titanium, sodium, lithium, manganese, barium, strontium, cesium, as well as hydroserecite and sericite $K_2O\cdot3Al_2O_3\cdot6SiO_2\cdot H_2O$;
- Up to 18% quartz SiO_2;
- 4-8% calcite $CaCO_3$ and 3-7% anhydride $CaSO_4$.

The shales also contain:

- Sulfide minerals: mainly pyrite FeS_2 (content ranges from 2.7% to 10%) and some sphalerite ZnS, as well as CdZnS (cadmium+sphalerite), wurtzite ZnS, chalcopyrite $CuFeS_2$, galena PbS, and molybdenite MoS_2;
- Oxides and hydroxides: magnetite, hematite, ilmenite, corvusite, tyuamunite, uvanite, sphene (titanite), rutile, molybdenite;
- Silicates and aluminosilicates: anorthite, microcline, chlorite, shamosite, pyroxene (diorite), zoisite, tourmaline, zeolites;
- Niobates, tantalates (microlite), and intermetallic compounds (chemical compounds made of two or more metals): cesium gold auride CsAu, magnesium intermetallics: MgB_2; MgZn; MgY; MgTl; AgMg; Mg_2Ge; Mg_2Sn; Mg_3Sb_2; sodium-tin intermetallics: $NaSn_3$; $NaSn_2$; NaSn; Na_4Sn_3;
- Na_3Sn; Na_4Sn, and others: GaAs (gallium arsenide); Au_4Al; Cu_2MnAl; Cu_9Al_4; $NiTe_2SmCo_5$; Fe_3Ni; Ni_2In; $LaNi_5$; $CeMg_{12}$; Nb_3Sn; Ni_3Al; Ni_3Nb; Ti_3Al; Al_2Cu; K_4Pb, and others.

RESULTS AND DISCUSSION

A distinctive feature of the metal-bearing bituminous shales is the presence of organometallic compounds, whose quantitative and qualitative characteristics are of particular interest both from an analytical and technological point of view (Isokov *et al.*, 2013).

Table 1: Mineralogical and chemical composition of oil shale of Sangruntau

Mineral composition		Main elemental composition		
Name	%	Ele-t	g/t**	g/t**
Kerogen, bitumoids	24,0	U	36,8-57	39,0
Montmorillonite	22,67	Mo	519-850	377,0
Biotite	18,5	Re	0,44-0,61	0,35
Quartz	13,4	Ni	250-960	223,0
Feldspar	7,4	Cu	120-130	92,4
Pyrite	4,43	Co	15-18	12,8
Limestone	4,0	Cd	43-45	-
Apatite	1,5	Zn	200-230	149,0
Iron hydroxide	1,3	Pb	17-24	-
Gypsum	0,7	As	40-45	8,55
Rutile	0,5	Sb	30-35	-
Sericite	0,4	Sr	160-250	-
Other substances	1,6	V	790-1200	108,0
Total	100	Mn	190-350	144,0

*Note: ***PPP includes hygroscopic H2O (1050C), constitutional water (water of carbohydrate, protein, and fat molecules), crystallization water (as part of salts, the crystal lattice of minerals), organic matter (OM), and CO2.*

The development of methods and criteria for geochemical exploration of concealed mineralization requires a detailed study of the distribution patterns of chemical elements in endogenous geochemical halos that form around ore bodies of various deposit types.
Such studies have been conducted at explored deposits, where the ore bodies and their endogenous halos are exposed through boreholes and mine workings.

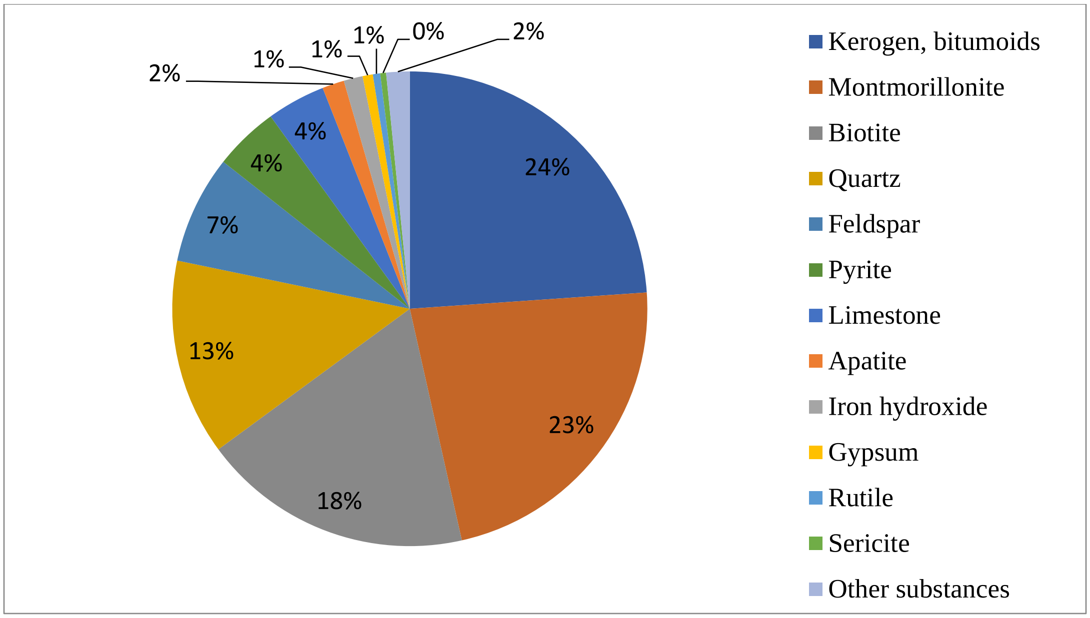

Fig. 1. Quantitative diagram of minerals in the composition of oil shale

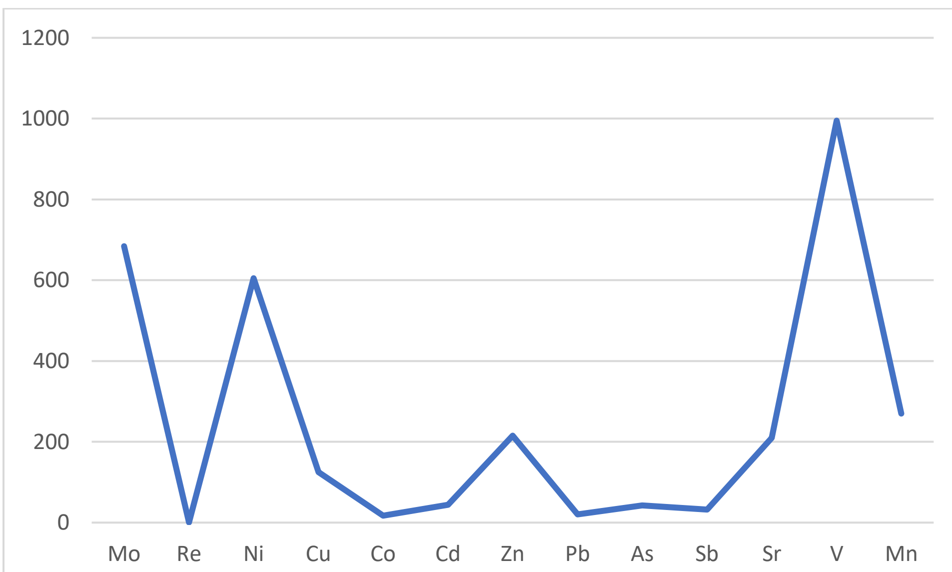

Fig. 2. Diagram of the elemental composition of oil shale

The main condition for selecting the object of experimental work was the presence of mine workings or boreholes that expose the upper and lower parts of the ore bodies and their endogenous halos. Endogenous halos were studied not only for concealed ore bodies but also for those that outcrop at the erosion surface. The described endogenous geochemical halos belong to deposits with different ore compositions, lying in various geological conditions.

Predominantly, these are steeply dipping ore bodies with host rocks of varying composition. Most of them are of hydrothermal origin, and only a few are of skarn type (Allabergenov and Akhmedov, 2012).

A sharp enrichment of heavy fractions of samples taken from endogenous halos with sulfides of uranium-associated elements (strontium, molybdenum, selenium, and iridium) indicates that the main form of occurrence of these elements in endogenous halos is sulfides. This conclusion is supported by a significant increase in the yield of heavy fractions from samples with anomalous concentrations of elements, compared to samples taken from areas with background concentrations.

The data on the forms of occurrence of chemical elements that form endogenous geochemical halos, such as strontium, molybdenum, selenium, iridium, and uranium ore bodies, suggest that their forms of occurrence are similar to those in ores (Astrakhantseva, 1968).

This allows us to confidently assume a close genetic relationship between the halos and ore bodies, as well as the similarity of their formation conditions. Considering that all chemical elements, except for uranium, whose endogenous halos have been described for strontium, molybdenum, selenium, iridium, and uranium ore bodies, occur in the form of sulfides, it becomes easier to select a methodology for rational geochemical analysis. This method, like for uranium, allows the identification of their so-called mobile forms. As will be shown later, this will help identify the contours of the actual, close to true, endogenous halos, which in turn will improve the depth of the method for exploring concealed mineralization based on endogenous geochemical halos.

CONCLUSION

Bituminous shales in Paleogene deposits are widely distributed in the Central Kyzylkum region of Uzbekistan. Their formation is associated with two basins: the Syrdarya and Amu Darya basins.

At the Sangruntau deposit, in addition to uranium, rare metals such as strontium, selenium, iridium, and molybdenum are found in the form of sulfides.

REFERENCES

Mirzaev AU (2011). Paleogene bituminous shales of Central Kyzylkum. *UzMU News*, *Tashkent*. No. 2/1. P. 77-80.

Isokov MU, **Turesebekov AH, Borminsky SI, Vasilyevsky BB, Sharipov KhT, Deryugin EK (2013).** Geochemistry and mineralogy of bituminous shales of Uzbekistan. *Ed. by B.A. Isakhodjaev*; State Committee for Geology of Uzbekistan, State Enterprise “NIIMR”, Institute of Geology and Geophysics of the Academy of Sciences of Uzbekistan, Ministry of VI&SCO of Uzbekistan, Tashkent Chemical-Technological Institute. Tashkent: State Enterprise “NIIMR”, 78 pages.

Allabergenov RD, Akhmedov RK (2012). Bituminous shales of Uzbekistan: innovation and diversification. *Proceedings of the Republican scientific and technical conference (November 8-9, 2012, Tashkent) "Current issues of oil and gas processing in Uzbekistan". – Tashkent: (IONH Academy of Sciences of Uzbekistan) "Fan" Publishing House*. 137-140.

Astrakhantseva OP (1968). Zelenin N.I. Some features of phenols in shale oil // Chemistry and technology of bituminous shales and their processing products. *Leningrad: Khimia*, 97-103.

Yanochkina ZA, Bukina TF (1982). The composition of bituminous shales of the Saratov Volga region. *Studies in the field of integrated energy-technological utilization of fuel. Saratov*: SPI, 9-11.