ISNN 3030-3907

2026/3
VOLUME 1

DEVELOPMENT OF SCIENCE

ILMIY JURNAL



Development of science

Ilmiy jurnal

2026/3 VOLUME 1

ISSN 3030 -3907

Ilmiy jurnal OAK rayosatining 2024 yil 27 sentabrdagi 361-son qaroriga asosan 02.00.00 kimyo fanlari hamda 2025 yil 12 fevral 367- son qaroriga asosan 05.00.00 texnika fanlari bo‘yicha falsafa doktori (PhD) va fan doktori (DSc) ilmiy darajasiga talabgorlarning dissertatsiya ishlari yuzasidan dissertatsiyalari asosiy ilmiy natijalarini chop etish tavsiya etilgan milliy ilmiy nashrlar ro‘yxatiga kiritilgan.

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ISSN 3030-3907

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ISSN 3030-3907

NEW TECHNOLOGICAL SOLUTIONS FOR IMPROVING CORE RECOVERY IN COMPLEX GEOLOGICAL CONDITIONS

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Annotation. This paper substantiates the relevance of research focused on the development of innovative technologies that are effectively applied in well drilling operations. An analysis of the existing modifications of core retrieval tools and their component parts used in drilling was conducted. Based on the study and analysis of current core retrieval tools and components, innovative solutions and designs were implemented in the research. For the purpose of testing these developments and performing core sampling, experimental prototypes of core retrieval tools and drill heads were fabricated.

Keywords: core, innovative development, core retrieval tool, cylindrical drill head, MSZ-type drill heads, JSC “Uzbekneftegaz”

Аннотация. В настоящей статье обоснована актуальность научно-исследовательских работ по созданию инновационных разработок, которые эффективно используются при бурении скважин. Выполнен анализ разработанных и используемых при бурении скважин модификаций керноотборных снарядов и комплектующих деталей. На основании изучения и анализа существующих керноотборных снарядов и комплектующих деталей в исследованиях применены инновационные решения и разработки. В целях апробации этих разработок и отбора керна изготовлены опытные образцы керноотборных снарядов, бурильные головки.

Ключевые слова: керн, инновационная разработка, керноотборный снаряд, цилиндрическая бурильная головка.

Annotatsiya. Ushbu maqolada quduqlarni burg'ulashda samarali qo'llaniladigan innovatsion texnologiyalarni ishlab chiqishga qaratilgan tadqiqotlarning dolzarbligi asoslab berilgan. Burg'ulashda qo'llaniladigan asosiy materiallarni olish vositalarining mavjud modifikatsiyalari va ularning tarkibiy qismlariga tahlil o'tkazildi. Hozirgi asosiy ma'lumotlarni olish vositalari va komponentlarini o'rganish va tahlil qilish asosida tadqiqotda innovatsion echimlar va dizaynlar

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amalga oshirildi. Ushbu ishlanmalarni sinab ko'rish va yadro namunalarini olish uchun yadro olish vositalari va burg'ulash boshlarining eksperimental prototiplari ishlab chiqarildi.

Kalit so'zlar: yadro, innovatsion rivojlanish, yadroni qidirish vositasi, silindrsimon burg'ulash boshi, MSZ tipidagi burg'ulash boshlari, "O'zbekneftgaz" aksiyadorlik jamiyati

INTRODUCTION

During the drilling of exploratory and appraisal wells for oil, gas, and solid mineral resources, core samples of rock formations are extracted to determine their physical, mechanical, and reservoir properties within the productive layer. These data enable the assessment of the hydrocarbon potential of the formation and allow for the calculation of its reserves.

There exist various designs of core retrieval tools. The most widely used is the “Nedra”-type core retrieval tool with its associated components. Despite its sophistication, core recovery in loose, porous, and fractured formations remains a technical challenge. The core recovery rate relative to the penetration achieved by the core retrieval tool is low, typically ranging from 30% to 60% or less [1].

Several factors contribute to the low efficiency of core recovery:

- The physical and mechanical properties of the formation being drilled (loose, porous-fractured, cavernous);
- Limitations of the core retrieval tool and drill head design;
- Non-compliance with proper core sampling techniques [2].

To provide scientific and technical support to production organizations in core sampling and to improve core recovery, the author has developed enhancements to both the tools and technologies used for core retrieval during the drilling of appraisal wells.

An analysis of core sampling practices in industrial organizations was conducted, which identified the main causes of low core recovery efficiency. As a result of this work, the drilling technology with core sampling has been improved, and a new design of the drill head has been developed, allowing for an increased core recovery rate [3].

Currently, a new design of cylindrical drill heads of the **MSZ type** (Fig. 1) has been manufactured and is already being applied in drilling operations in the oil and gas condensate regions of Uzbekistan. The core recovery results are presented in Table 1.

Previously, core retrieval tools and drill heads were imported from other countries (Russia, China) [4].

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At present, the serial production of core retrieval tools, drill heads, and core holders has been organized. The expansion of serial manufacturing of these developed technical solutions will contribute to the import substitution of drilling equipment and will reduce foreign currency expenditures associated with geological exploration and drilling operations. This represents a contribution to the localization of imported products, the expansion of domestic production of import-substituting technologies, and the enhancement of the informativeness of geological exploration for oil and gas.

The core retrieval tool and its component parts have been improved and successfully tested in wells operated by JSC “Uzbekneftegaz,” achieving a significant increase in core recovery [5].

Specifically, a core retrieval tool with a diameter of 168/80 mm and cylindrical **MSZ-type drill heads** with Ø187.3/80 mm (Figs. 1 and 2) have undergone field testing in wells [7].

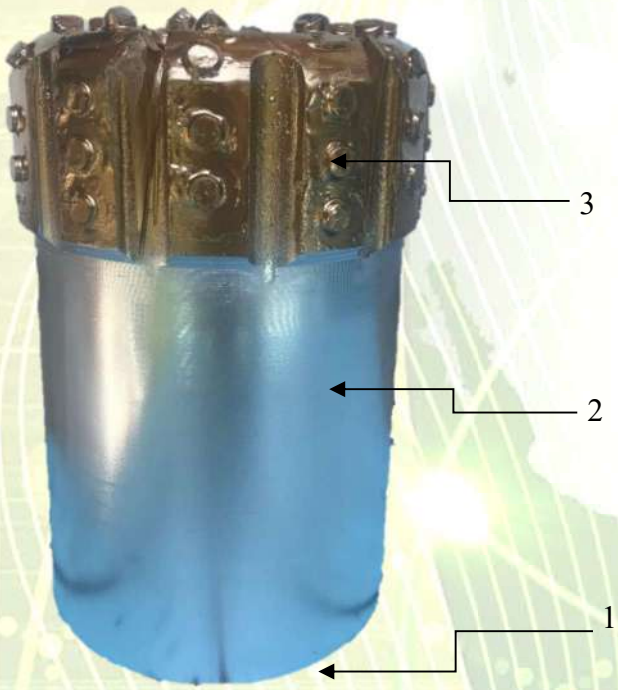


Fig. 1. Cylindrical drill head of the "MSZ" type. 1– coupling with connecting thread; 2– housing; 3– blades.

Table 1.

Core Recovery in the Bukhara-Khiva Region Using MSZ-Type Cylindrical Drill Heads

No.	Area Name / Field Name	Sampling Interval, m	Drill Bit Diameter,	Drilling Fluid Parameters	Core Sampling Mode / Conditions	Core Recovery, %

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				Density, g/cm³	Apparent Viscosity, s	Filtration, cm³/30 min	Filter Cake Thickness	pH	Rotor Speed, rpm	Bit Pressure, atm	Load, t	Pump Rate / Flow Rate, L/s	
1	Temirkazgan	2264-2268	158,7	1,12	45	6	1	9	30	20	2,5	10	60
2	Chakkakum Well No. 4	2190-2192	187,3	1,15	35	5	1	9	35	15	2,5	7	75
3	Andakli	2515-2520	187,3	1,13	40	5	1	9	35	20	2,5	8	80
4	Andakli	2192-2197	187,3	1,12	55	6	1	9	40	20	2,5	7	80
5	Murottepa Well No. 4	2801-2805	187,3	1,15	35	5	1	8	40	15	2	8	87,5
6	Tumaris Well No. 2	1955-1957	158,7	1,12	35	5	1	9	40	15	4	8	100
7	Temirkazgan	2580-2584	158,7	1,08	55	5	1	9	50	22	5	16	100

Note: Core recovery in 2019–2020 reached 84%. Patents were obtained for the core retrieval tools and MSZ-type cylindrical drill heads under certificates No. EC-01-002231 and EC-002339.

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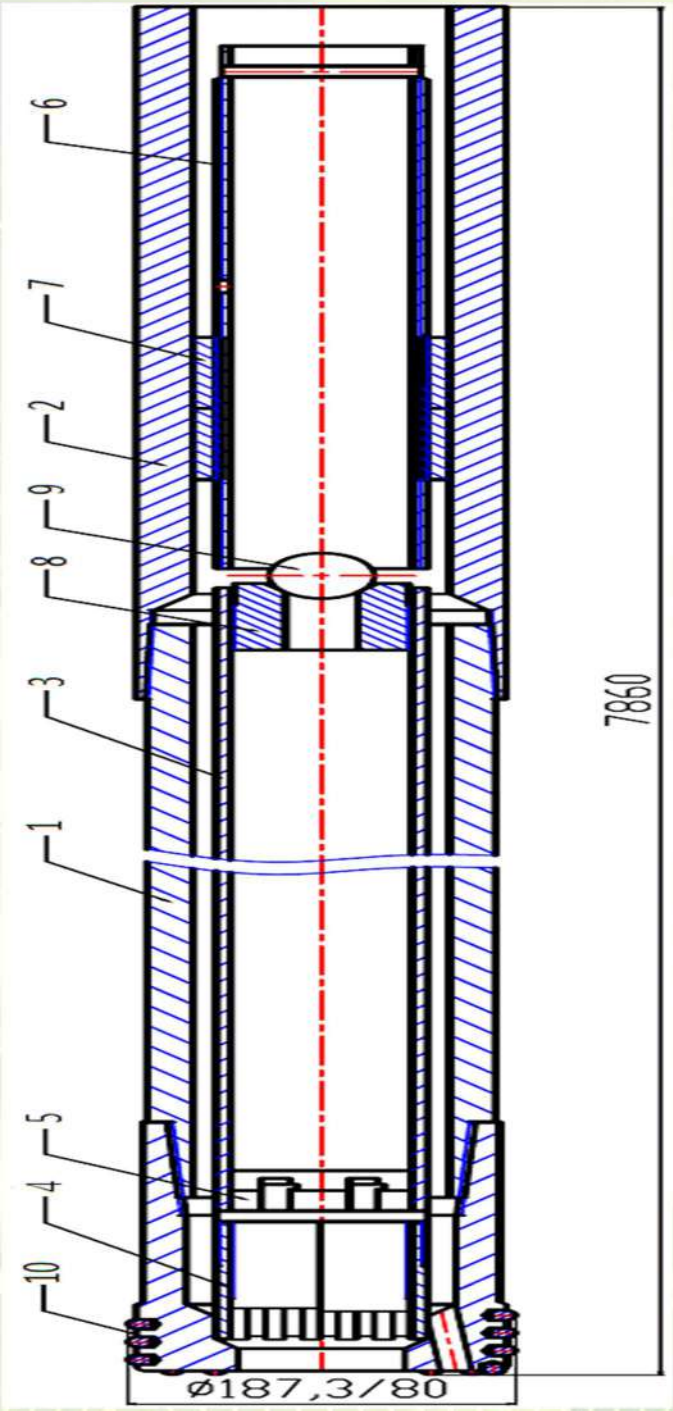


Fig. 2. Core-collecting projectile (CBS) with a cylindrical drill head 1-housing, 2 upper adapter, 3 core intake pipe, 4-collet holder, 5 petal plucker, 6 adjusting screw, 7 adjusting nut, 8-ball socket, 9-ball (Ø 50.8 mm), 10-cylindrical drill head.

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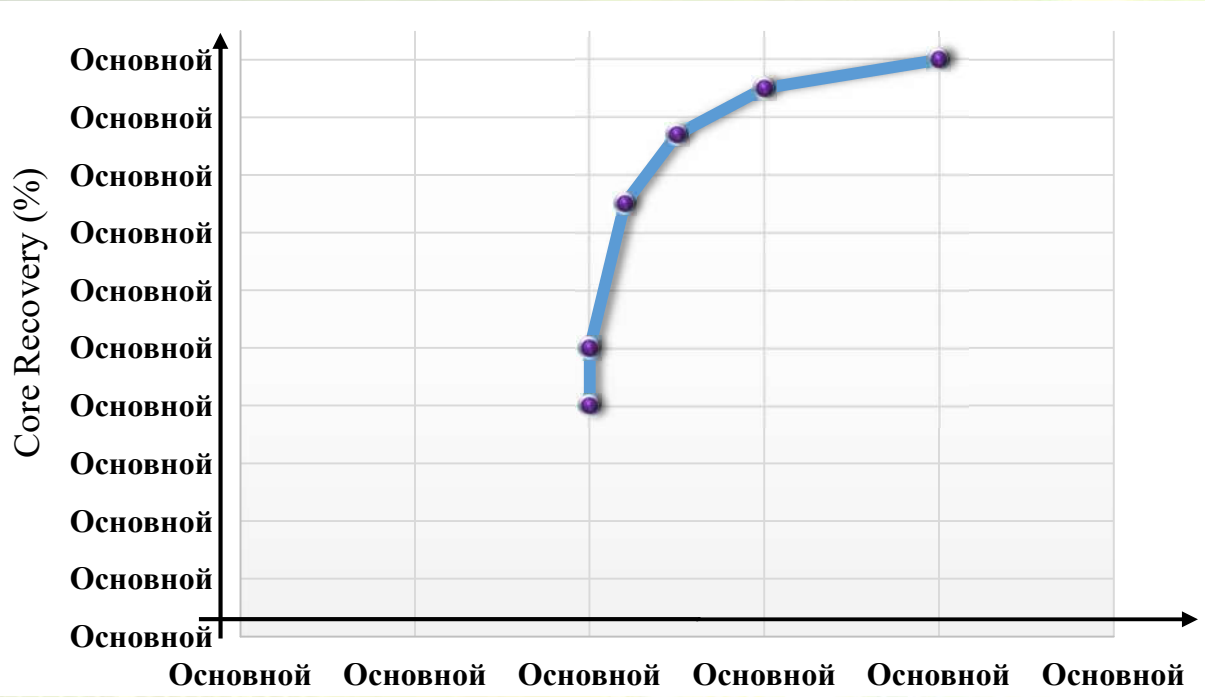


Fig. 3. Dependence of core recovery percentage on axial load using MSZ-type cylindrical drill bits.

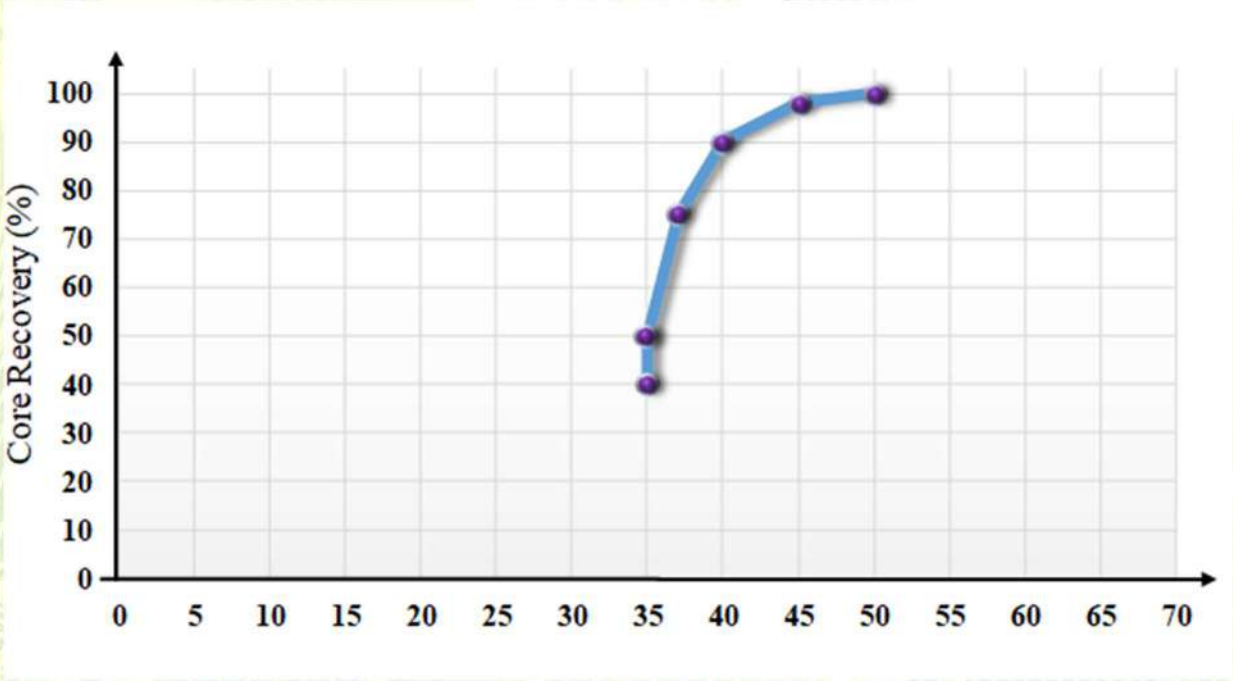
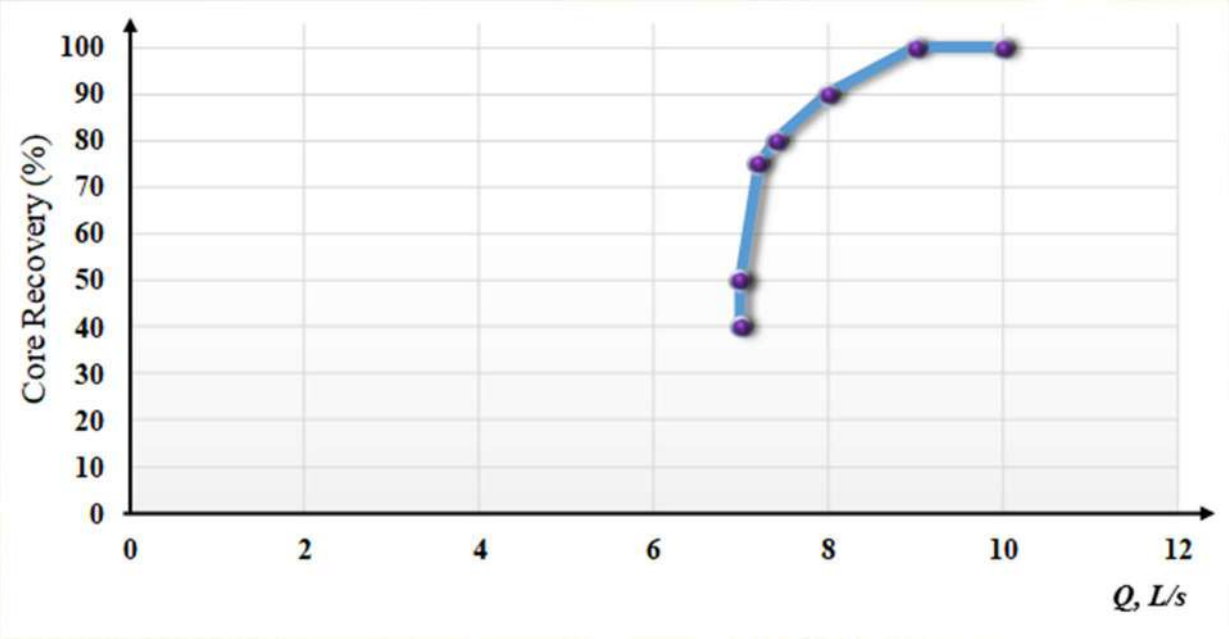


Fig. 4. Dependence of Core Recovery Percentage on Rotor Rotation Using MSZ-Type Cylindrical Drill Bits.

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Fig.5. Dependence of Core Recovery Percentage on Drilling Pump Performance Using MSZ-Type Cylindrical Drill Bits.

Testing was carried out under the technological conditions presented in Figs. 3–5. According to the test results, the average core recovery coefficient increased from 73% to 84%. A patent was obtained for the drill heads under certificate No. EC-01-002231. Based on the test results, an implementation report was issued [3, 9].

CONCLUSION

Core retrieval tools have been developed for use in core drilling of oil and gas wells, including a core retrieval tool designated as “KOS,” designed to reduce vibration during core drilling and to preserve the core within the core barrel. In addition, field testing was conducted using the “KOS” core retrieval tool in combination with the newly developed and manufactured PDC drill head and a conical spring-type core holder.

A core drilling technology has been established that promotes complete recovery of core material, highlighting its critical importance for the accurate study of productive formations and the achievement of effective exploration results, as well as reliable geological data.

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