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ҚАЙЫРЫМДЫЛЫҚ ҚОРЫ HALYK CHARITY FOUNDATION

«ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫ» РҚБ
«ХАЛЫҚ» ЖҚ

ХАБАРЛАРЫ

ИЗВЕСТИЯ

РОО «НАЦИОНАЛЬНОЙ
АКАДЕМИИ НАУК РЕСПУБЛИКИ
КАЗАХСТАН»
ЧФ «Халық»

N E W S

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NAS RK is pleased to announce that News of NAS RK. Series of geology and technical sciences scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of geology and technical sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы «ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы» ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Webof Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

ЧФ «ХАЛЫҚ»

В 2016 году для развития и улучшения качества жизни казахстанцев был создан частный Благотворительный фонд «Халык». За годы своей деятельности на реализацию благотворительных проектов в областях образования и науки, социальной защиты, культуры, здравоохранения и спорта, Фонд выделил более 45 миллиардов тенге.

Особое внимание Благотворительный фонд «Халык» уделяет образовательным программам, считая это направление одним из ключевых в своей деятельности. Оказывая поддержку отечественному образованию, Фонд вносит свой посильный вклад в развитие качественного образования в Казахстане. Тем самым способствуя росту числа людей, способных менять жизнь в стране к лучшему – профессионалов в различных сферах, потенциальных лидеров и «великих умов». Одной из значимых инициатив фонда «Халык» в образовательной сфере стал проект Ozgeris powered by Halyk Fund – первый в стране бизнес-инкубатор для учащихся 9-11 классов, который помогает развивать необходимые в современном мире предпринимательские навыки. Так, на содействие малому бизнесу школьников было выделено более 200 грантов. Для поддержки талантливых и мотивированных детей Фонд неоднократно выделял гранты на обучение в Международной школе «Мирас» и в Astana IT University, а также помог казахстанским школьникам принять участие в престижном конкурсе «USTEM Robotics» в США. Авторские работы в рамках проекта «Тәлімгер», которому Фонд оказал поддержку, легли в основу учебной программы, учебников и учебно-методических книг по предмету «Основы предпринимательства и бизнеса», преподаваемого в 10-11 классах казахстанских школ и колледжей.

Помимо помощи школьникам, учащимся колледжей и студентам Фонд считает важным внести свой вклад в повышение квалификации педагогов, совершенствование их знаний и навыков, поскольку именно они являются проводниками знаний будущих поколений казахстанцев. При поддержке Фонда «Халык» в южной столице был организован ежегодный городской конкурс педагогов «Almaty Digital Ustaz.

Важной инициативой стал реализуемый проект по обучению основам финансовой грамотности преподавателей из восьми областей Казахстана, что должно оказать существенное влияние на воспитание финансовой грамотности и предпринимательского мышления у нового поколения граждан страны.

Необходимую помощь Фонд «Халык» оказывает и тем, кто особенно остро в ней нуждается. В рамках социальной защиты населения активно проводится

работа по поддержке детей, оставшихся без родителей, детей и взрослых из социально уязвимых слоев населения, людей с ограниченными возможностями, а также обеспечению нуждающихся социальным жильем, строительству социально важных объектов, таких как детские сады, детские площадки и физкультурно-оздоровительные комплексы.

В копилку добрых дел Фонда «Халык» можно добавить оказание помощи детскому спорту, куда относится поддержка в развитии детского футбола и карате в нашей стране. Жизненно важную помощь Благотворительный фонд «Халык» оказал нашим соотечественникам во время недавней пандемии COVID-19. Тогда, в разгар тяжелой борьбы с коронавирусной инфекцией Фонд выделил свыше 11 миллиардов тенге на приобретение необходимого медицинского оборудования и дорогостоящих медицинских препаратов, автомобилей скорой медицинской помощи и средств защиты, адресную материальную помощь социально уязвимым слоям населения и денежные выплаты медицинским работникам.

В 2023 году наряду с другими проектами, нацеленными на повышение благосостояния казахстанских граждан Фонд решил уделить особое внимание науке, поскольку она является частью общественной культуры, а уровень ее развития определяет уровень развития государства.

Поддержка Фондом выпуска журналов Национальной Академии наук Республики Казахстан, которые входят в международные фонды Scopus и Wos и в которых публикуются статьи отечественных ученых, докторантов и магистрантов, а также научных сотрудников высших учебных заведений и научно-исследовательских институтов нашей страны является не менее значимым вкладом Фонда в развитие казахстанского общества.

С уважением,
Благотворительный Фонд «Халык»!

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ANALYSIS OF THE QUALITY OF UNDERGROUND MINERAL WATERS OF TERRIGENOUS DEPOSITS OF THE HAUTERIV-BARREMIAN AQUIFER OF THE LOWER CRETACEOUS

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Abstract. The most important task in the development of hydrogeological science is to comprehensively study the possibilities of using groundwater for various household, economic and industrial needs, such as water supply, irrigation, and the construction of hydraulic structures. The relevance of the problem being solved is mainly due to the fact that groundwater is considered as isolated jets coming out of the earth's interior, in no way connected with the hydrogeological situation in the surrounding world. The aim of the work is to analyze the quality of underground mineral waters of terrigenous deposits of the Hauterivian-Barremian

aquifer complex of the Lower Cretaceous. The object of the work is the Biragzang deposit of thermal mineral waters, with. Upper Biragzang, Alagir district, North Ossetia-Alania. Geological problems are solved by a complex of hydrogeological studies, including the collection and generalization of geological information on previous work in the area and at the site of the water intake, groundwater monitoring for one year and subsequent processing and generalization of its results, experimental filtration work, with compilation report with the calculation of groundwater reserves. An assessment of the state of groundwater was carried out, hydrodynamic and qualitative indicators were analyzed. The possibility of extracting high-thermal medical-table low-mineralized bicarbonate sodium groundwater in the declared volumes of approximately 120 m^3/day at a dynamic level of 38.3 m was substantiated.

Keywords: high-thermal low-mineralized medical table water of bicarbonate sodium composition, well, alkaline reaction of the medium, Chernogorskaya monocline, terrigenous deposits of the Hauteriv-Barrem aquifer complex of the Lower Cretaceous, water inflow interval, experimental hydrogeological studies, regime observations, piezometric level, flow rate, mineralization

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ТӨМЕНГІ БОР ДЕҢГЕЙІНІҢ ГАТЕРИВ-БАРРЕМ СУЛЫ КЕШЕНІНІҢ ТЕРРИГЕНДІ ШӨГІНДЕРІНІҢ КЕШЕНДІ МИНЕРАЛДЫ СУЛАРЫНЫҢ САПАСЫН ТАЛДАУ

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Аннотация. Орыс гидрогеология ғылымының дамуындағы ең маңызды міндет жер асты суларын сумен жабдықтау, суару, гидротехникалық құрылыстар салу сияқты әртүрлі тұрмыстық, шаруашылық және өндірістік қажеттіліктерге пайдалану мүмкіндіктерін жан-жақты зерттеу болып табылады. Шешіліп жатқан мәселенің өзектілігі, негізінен, жер асты суларының жердің ішкі қабатынан шығатын оқшауланған ағындар ретінде қарастырылуымен байланысты, олар қоршаған әлемдегі гидрогеологиялық жағдаймен ешқандай байланысы жоқ. Жұмыстың мақсаты: Төменгі бордың Гаутерив-Барремдік сулы горизонт кешенінің терригенді кен орындарының жер асты минералды суларының сапасын талдау. Жұмыстың объектісі Бірагзаң термалды минералды сулар кен орны болып табылады. Жоғарғы Бирагзанг, Алагир ауданы, Солтүстік Осетия-Алания. Геологиялық мәселелер гидрогеологиялық зерттеулер кешенімен шешіледі, оның ішінде ауданда және су алу орнында бұрын атқарылған жұмыстар туралы геологиялық ақпаратты жинау және жалпылау, жер асты суларының бір жыл бойына мониторингі және оның нәтижелерін кейінгі өңдеу және жалпылау, тәжірибелік сүзгілеу. жұмыс, жер асты суларының қорын есептеп құрастыру есебімен. Жер асты суларының жай-күйін бағалау жүргізілді, гидродинамикалық және сапалық көрсеткіштерге талдау жасалды. Тәулігіне шамамен 120 м3 мәлімделген көлемде 38,3 м динамикалық деңгейде жоғары термиялық емдік-үстелдік төмен минералданған гидрокарбонатты натрий жер асты суларын алу мүмкіндігі негізделді.

Түйін сөздер: бикарбонатты натрий құрамы жоғары термиялық төмен минералданған емдік ас суы, ұңғыма, ортаның сілтілі реакциясы, Черногорская моноклиналы, төменгі бор кезеңінің Гаутерив-Баррем сулы горизонт кешенінің терригендік шөгінділері, судың түсу аралығы, тәжірибелік гидрогеологиялық зерттеулер, режимдік бақылаулар, пьезометриялық деңгей, ағын жылдамдығы, минералдану

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АНАЛИЗ КАЧЕСТВА ПОДЗЕМНЫХ МИНЕРАЛЬНЫХ ВОД ТЕРРИГЕННЫХ ОТЛОЖЕНИЙ ГОТЕРИВ-БАРРЕМСКОГО ВОДОНОСНОГО КОМПЛЕКСА НИЖНЕГО МЕЛА

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Аннотация. Важнейшей задачей развития гидрогеологической науки является всесторонне изучение возможностей использования подземных вод для различных бытовых, хозяйственных и производственных нужд, таких как водоснабжение, орошение и строительство гидротехнических сооружений. Актуальность решаемой проблемы главным образом обусловлена тем, что подземные воды рассматриваются в качестве изолированных струй, выходящих из земных недр, никоим образом не связанных с гидрогеологической ситуацией в окружающем мире. Целью работы является проведение анализа качества подземных минеральных вод терригенных отложений готерив-барремского водоносного комплекса нижнего мела. Объектом работы служит Бирагзангское месторождение термальных минеральных вод, с. Верхний Бирагзанг, Алагирский район, РСО-Алания. Геологические задачи решаются путем комплекса гидрогеологических исследований, включающих сбор и обобщение геологической информации по ранее проводимым работам в районе

и на участке расположения водозабора, проведение мониторинга подземных вод в течение одного года и последующая обработка и обобщение результатов, проведение опытно-фильтрационных работ, с составлением отчета с подсчетом запасов подземных вод. Авторами проведена оценка состояния подземных вод, проанализированы гидродинамические и качественные показатели и обоснована возможность добычи высокотермальных лечебно-столовых слабоминерализованных гидрокарбонатных натриевых подземных вод в заявленных объемах примерно 120 м^3/сут при динамическом уровне – 38,3 м.

Ключевые слова: высокотермальная слабоминерализованная лечебно-столовая вода гидрокарбонатного натриевого состава, скважина, щелочная реакция среды, Черногорская моноклиналь, терригенные отложения готерив-барремского водоносного комплекса нижнего мела, интервал водопритока, опытные гидрогеологические исследования, режимные наблюдения, пьезометрический уровень, дебит, минерализация

Introduction

At the initial stage of the research, stock materials on geological and hydrogeological works and meteorological observations previously carried out in the area under consideration, located on the territory of North Ossetia-Alania, were studied. As a result, initial data on the well were obtained. At this stage, geological reports on the results of prospecting and exploration work were analyzed both in the Biragzang area of mineral waters and in the adjacent area. In addition, similar works were analyzed in other countries, in particular (Saibi et al., 2021; Pasvanoğlu et al., 2021; Zholtayev et al., 2018).

Well No. 1 at the Biragzang site was drilled at the stage of a detailed search for thermal mineral waters conducted in 2012–2013. A gas survey was carried out by the Gas Geochemical Party of the Moscow Geological Prospecting Institute. Anomalous gas halos were revealed in the subsoil air of sediments overlying bedrocks of various lithological compositions and faults in them. Subsoil air samples were taken from wells with a depth of 0.9 ... 1.3 m, a diameter of 60 mm for gas components-indicators. The content of CO_2, H_2, O_2, N_2, CH_4, CO_2, and He was determined. Several zones with anomalous CO_2 content were identified, due to subvertical migration of carbon dioxide over fluid-conducting systems, coinciding with zones of increased rock fracturing (Marques et al., 2020). The area of the survey was 1.5 sq. km. The data of these works made it possible to significantly clarify the details of the geological structure of the valley of the river closed by sediments. Ardon and its gentle slopes, which made it possible to more reasonably choose the location of deep well No. 1BT (Klyuev et al., 2020; Klyuev et al., 2021).

Well No. 1 was drilled with a BU-3000 BD rig. Its design depth was determined at 2350 m in such a way as to cross the entire thickness of the sandy-clay deposits of the Kichmalka suite (K_1kc) of the aquifer Hauterivian-Barremian terrigenous complex, from which to well No. water inflows were obtained with a flow rate

of about 35–50 dm^3/s. To a depth of 1141 m, the well is cased with a D-245 mm technical string and the annular space is cemented along the entire length of the string. After reaching the target depth (2370 m), the well was cased in the interval of 1050–2370 m with a D-168 mm string and the annulus was also cemented throughout the entire interval. The wells in the study, in which water samples were taken, were considered using the methods given in the publication (Kassenov et al., 2018).

Based on the results of well logging in well No. 1, zones of the most permeable rocks were identified in the Early Cretaceous sediments penetrated by the well, to be tested for the inflow of thermal mineral water by perforating a casing string with a diameter of 168 mm from bottom to top (Klyuev et al., 2020; Ayvaz et al., 2018). After declining the well, the following intervals were perforated: 2160–2156, 2150–2146, 2142–2136, 2106–2102, 2100–2096, 2084–2080, 2068–2064 m. A total of 30 m of casing pipes with a diameter of 168 mm were perforated.

The well was flushed for two days, and then a test release was made (2064–2160 m). The flow rate of water with a fully open valve stabilized at a value of 5.6 l/s, the water temperature was 53 °C. In the process of observing the level recovery, the pressure rose to 268 m above the surface.

At the present stage of subsoil use, the actual production of mineral waters from well No. 1 is carried out in a stable mode (Moldashi et al., 2021; Lyashenko et al., 2020) and does not exceed 150 m3/day. In 2018, a pool 20x 30 m in size and 1.5 m deep was built 10 m from the well, where water is supplied from the well around the clock. Residents and guests of the republic come here all year round to take hot baths. In the future, Aqua-Don LLC plans to carry out industrial bottling of mineral water. The conducted studies contain the provisions of the technologies presented in the article (Stepanets et al., 2018).

Materials and methods

Study of the groundwater regime. Regime observations at the site were carried out for 1 year - from June 2016 to July 2017. Measurements for the entire period were carried out at an adjusted flow rate (license limit) of 1.74 l/s. As a result of the monitoring, all seasons of the calendar year were covered. The data obtained were further used in the analysis of the available groundwater supply of the site (Jgamadzea et al., 2018; Hollis et al., 2017). The flow rate of the wells was determined by the volumetric method - by the time of filling the measuring tank - a standard barrel with a volume of 200 dm^3. Measurements of the level (pressure) of groundwater were made using a 25 atm manometer mounted at the wellhead. Groundwater temperature observations were carried out directly at the wellhead, in accordance with the generally accepted methodology. Results of regime observations in 2018–2019 flow rate, head, water and air temperatures are shown in Figure 1.

As a result of the observations, it can be concluded that for the period from 2017–2018. to 2018–2019 no noticeable change in water pressure in the well and flow rate was recorded.

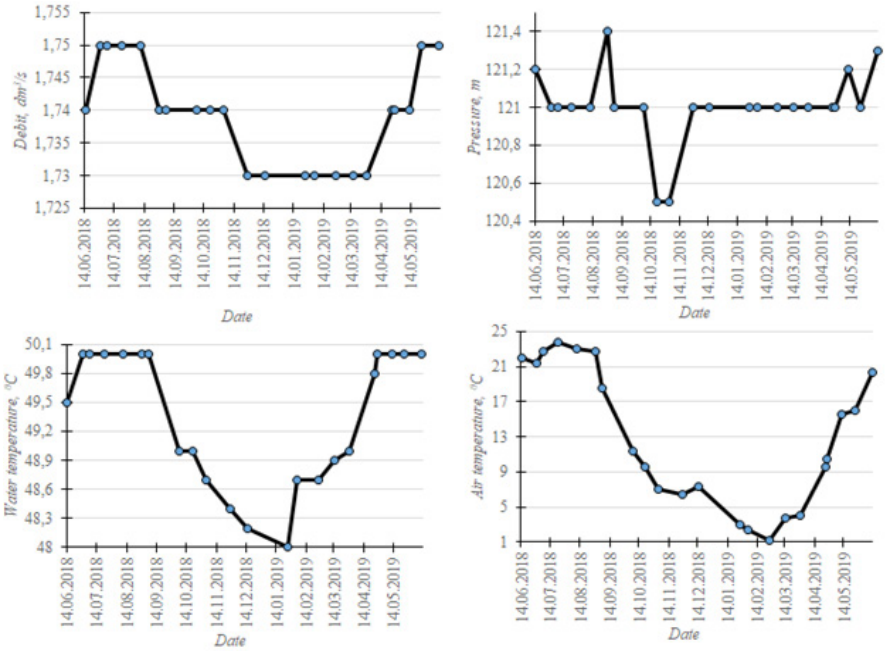

Figure 1 - Graphs of monitoring observations

Experimental and experimental-operational hydrogeological studies. Experimental and pilot-operational hydrogeological studies were carried out in 3 stages: Stage I - removal of the "natural background". At this stage, the problem was solved of obtaining data characterizing the initial situation before a long period of artificially created regime, corresponding to the operating conditions of the well in the future with the selection of the declared water demand. Stage II - pilot production. This stage was the main one, according to the results of which the initial data were taken, according to the assessment of operational reserves. During the pilot production, a slight dependence of the well regime on climatic factors was revealed (Sabri et al., 2019; Apollaro et al., 2019). The rapid recovery of the level and a fairly stable chemical composition of the well water under various operating modes, starting from the time of completion of hydrogeological studies (2018) and during the period of experimental hydrogeological studies until their completion, indicate the reliability of the well when operating with a flow rate equal to the declared demand (Lu et al., 2017; Hebblewhite et al., 2020).

Sample selection. The sampling included taking water samples for hydrochemical (complete and typical) analyzes during experimental hydrogeological studies. Considering the data from experiments and the experience of several scientists in the study area, a more qualitative analysis of groundwater was carried out (Mitrofanova et al., 2017; Osipov et al., 2017; Romanova et al., 2017).

At the end of the pilot run, a water sample was taken for a complete chemical analysis (control analysis) (Alakangas et al., 2020; Zhan et al., 2018). Water

sampling for sanitary and bacteriological studies was carried out in accordance with sanitary and epidemiological rules and regulations in dark glass bottles of 0.5 liters each. Samples were stored in a refrigerator in a vertical position (cork down).

Composition and classification of underground waters. According to their chemical composition, degree of mineralization, and gas composition, groundwater in the study area is divided into fresh and mineral (Maldaner et al., 2018; McLean et al., 2019; Farlin et al., 2019).

Mineral water. According to the circulation conditions, mineral waters are stratal fissured. They can be divided into two groups: sulfide and without "specific components and properties."

The group of sulfide mineral waters is located in the southern part of the area under consideration and is confined to zones of tectonic faults in the band of distribution of carbonate rocks of the Upper Jurassic (Titonian and Kimmeridgian stages). The wells drilled in the lower part of the Tamiskdon River valley from the Tithonian sediments brought out self-flowing waters of sulfate magnesium-calcium composition with mineralization up to 4.1 g/dm3 and H2S content up to 240 mg/dm3.

Sodium chloride and sodium-calcium waters were obtained by wells No. 1 (in the range of 1230–1440 m) and No. 3T (in the range of 103–398 m). In well No. 1, with self-discharge in an open hole, these waters had a very insignificant flow rate (0.0007 dm3/s), mineralization of 5.7 g/dm3, and a temperature of 21 ºC. In well No. 3T from the Upper Cretaceous carbonate deposits (interval 103–398 m), during pumping with a very low flow rate (about 0.15 ... Silic acid (3.9 mg/dm3) was present in water in small amounts.

Calcium-sodium chloride waters were discovered in well No. 3T in Tithonian limestones (Upper Jurassic). Pressure water with a formation pressure of 27.4 MPa, but with an insignificant flow rate (0.03 ... 0.1 dm3 / s) and salinity of 7.5 ... 10.4 g / dm dm3), boric acid (up to 21 mg/dm3) and volatile phenols in increased amounts (up to 6.3 mg/dm3).

After the completion of drilling and testing of well No. 3T (2014), the salinity of water taken out of the Barremian stage deposits decreased from 1.0 to 0.7…0.85 g/dm, as a result, these waters have moved from the category of medical table waters to the natural table ones.

Discussion

Assessment of the conditions of natural protection of groundwater. One of the most important factors characterizing the protection of the groundwater of the site are: the pressure character of the target aquifer; significant depth of formation of the mineral waters of the region. An additional condition that ensures the protection of groundwater in the assessed area is the presence of cementation of the well annulus. No. 1 from the surface of the earth to a depth of 50 m, which hinders the penetration of pollutants into the target aquifer. The combination of these factors makes it possible to classify the groundwater of the site as protected.

Natural hydrogeological model of the site and schematization of hydrogeological

conditions. Pliocene deposits are developed in the northern part of the described territory and are mainly represented by coarse clastic sediments (conglomerates, sandstones, etc.). In the geological literature, these sediments are called the sequence of dislocated conglomerates, which in turn is subdivided into the sequence of upper (N_2-Q_Erd) and lower (N_{1-2}ls) conglomerates (Lysogorskaya suite). In the hydrogeological literature, this sequence corresponds to the aquiferous Akchagyl-Apsheron terrigenous complex and the weakly aquiferous Meotic-Pontic terrigenous complex, respectively. The total thickness of the Pliocene deposits can be more than 1300 m, however, for the purposes of fresh water supply, individual consumers use only the upper part of the Akchagyl-Apsheron, which was uncovered by scattered single wells.

Weakly water-bearing Miocene terrigenous complex (N_1). The Miocene sediments are mainly represented by clays with interlayers of marls, sands, and sandstones. In well No. 1, this sequence was penetrated in the interval of 30–200 m and is represented by clays with sandstone interbeds. The thickness of this complex to the north of the described area varies from 300 to 1000 m.

Impermeable Maikop terrigenous complex (P_3–N_1 mk). A thick member (800–1000 m) of clay formations of the Maikop series of Oligocene and lower Miocene sediments serves as a screen on the path of groundwater circulation.

Impermeable locally aquiferous Paleogene complex (P_2 fs). Marls and clays of the foraminiferal series within the described area are considered as water-resistant strata, although sometimes, under favorable geological and structural conditions, relatively small water inflows can be found in them.

According to the results of testing the well in 2015 and further in 2017–2018, in the process of geological study of the subsoil area, it was found that the mineralization of water decreased to 1 g/dm^3 and, due to a change in the chemical composition, water of chloride-hydrocarbonate sodium composition.

Similar studies are being carried out in various regions of the world, in particular in the Republic of Kazakhstan; increased attention is paid to the solution to the issues posed in the article, due to the presence of significant underground mineral waters in the territory (Malkovsky et al., 2016).

Results

To assess the quality of mineral waters, the results of chemical analyzes carried out in 2018–2019 were also involved. The indicators characterizing the quality of groundwater in the site were considered: data from analyzes conducted in 2017–2018. and testing in 2018–2019 The macrocomponent composition of water includes the content of the following components, mg/dm3: cations (sodium: 248 ÷ 302.9; potassium: 1.5 ÷ 3.2; magnesium: 0.04 ÷ 0.061; calcium: 0.7 ÷ 2.0) ; anions (chlorine: 55.6 ÷ 66.8; sulfate: 46.1 ÷ 76.1; bicarbonate: 378.3 ÷ 531.0; dry residue: 675.0 ÷ 707.0; salinity: 0.9 ÷ 1 ,one. Generalized indicators are shown in Table 1.

Table 1 - Generalized indicators

Indicators	Unit of measurement	Maximum permissible concentration, mg/dm^3, no more	Content		Number of analyzes
			from	before	
Hydrogen indicator	unit *pH*	6.5…8.5	8.35	9.2	6
General hardness	mg-eq/dm^3	7	0.03	0.06	6
Oil product	mg/dm^3	0.1	undefined	undefined	3
Phenols	mg/dm^3	0.001	undefined	undefined	3
Oxidability permanganate	mgO/dm^3	5	0.25	1.28	4

In 2017 (January 28, 2017), FGU SE «Sevosgeologorazvedka» tested well No. 1, after which, before the start of the geological survey of the subsoil area (until 2017), well No. 1 was not tested. Within one year, from July 2017 to June 2018, during the quarterly hydrochemical testing of the well, it was revealed that, compared to 2015, the water quality of the studied aquifer complex has undergone a significant change: mineralization has decreased.

In order to obtain timely reliable information necessary for making operational decisions to ensure the rational use of the mineral waters of the site, control over their condition under the influence of man-made and natural factors, object monitoring of groundwater is provided according to the attached scheme (Table 2).

Table 2 - Scheme of object monitoring of mineral groundwater at the site

Object of observation	Observation points	Observed indicators	Measurement method	Periodicity
Exploited aquifer complex of terrigenous sediments of the Hauterivian-Barremian stages (K1g-br), 2064–2160 m	Well No. 1	Debit	Volume	1 time per mont
		Water level	By pressure gauge	1 time per mont
		Water temperature	thermometer	1 time per mont
		Water quality control	According to a specially developed production quality control program	- 3 times a year for a typical (abbreviated) chemical analysis of water; - once a year for a complete chemical analysis of water; - 4 times a year for water analysis.
Technical condition	Well No. 1	The condition of the wellbore, wellhead piping, pavilion, etc.	-	1 time per year
High Security Zone	Subsoil plot	Potential sources of pollution; established regulations for economic activities in the zone of strict regime	Visual inspection by the subsoil user together with representatives of Rospotrebnadzor for North Ossetia-Alania	1 time per year

Recording of mineral water monitoring data is carried out in a special regime observation log, which should also reflect the results of well repair work, water sampling for chemical and bacteriological analyses.

Conclusion

In the period 2019–2020 on the subsoil plot, exploited with the help of well No. 1, located on the southern outskirts of the village. Upper Biragzang of the Alagir region of North Ossetia-Alania, hydrogeological studies were carried out in order to reassess the groundwater reserves of the Hauteriv-Barrem terrigenous complex. The research includes the following set of works: regime observations in well No. 1; experimental and pilot production; laboratory studies (chemical sanitary-bacteriological, radiological analyzes of water). An assessment of the state of groundwater was carried out, hydrodynamic and qualitative indicators were analyzed. The possibility of extracting high-thermal therapeutic-table low-mineralized bicarbonate sodium groundwater in the declared volumes of approximately 120 m^3/day at a dynamic level of 38.3 m was substantiated.

REFERENCES

Alakangas L.J., Mathurin F.A., Åström M.E. (2020). Diverse fractionation patterns of Rare Earth Elements in deep fracture groundwater in the Baltic Shield – Progress from utilisation of Diffusive Gradients in Thin-films (DGT) at the Äspö Hard Rock Laboratory // Geochimica et CosmochimicaActa. — V. 269. — Pp. 15–38. — https://doi.org/10.1016/j.gca.2019.10.026.

Apollaro C., Buccianti A., Vespasiano G., Vardè M., Fuoco I., Barca D., Bloise A., Miriello D., Cofone F., Servidio A., De Rosa R. (2019). Comparative geochemical study between the tap waters and the bottled mineral waters in Calabria (Southern Italy) by compositional data analysis (CoDA) developments // Applied Geochemistry. — Vol. 107. — Pp. 19–33. — https://doi.org/10.1016/j.apgeochem.2019.05.011.

Hebblewhite B. (2020). Fracturing, caving propagation and influence of mining on groundwater above longwall panels–a review of predictive models // International Journal of Mining Science and Technology. — Vol. 30. — Pp. 49–54. https://doi.org/10.1016/j.ijmst.2019.12.001.

Hollis S.P., Mole D.R., Gillespie P., Barnes S.J., Tessalina S., Cas R.A.F., Hildrew C., Pumphrey A., Goodz M.D., Caruso S., Yeats C.J., Verbeeten A., Belford S.M., Wyche S., Martin L.A.J. (2017). // 2.7Ga plume associated VHMS mineralization in the Eastern Goldfields Superterrane, Yilgarn Craton. — Vol. 291. — 119–142. — https://doi.org/10.1016/j.precamres.2017.01.002.

Jgamadzea A., Gabechavaa J., Gvakhariaa V., Sozashvilia D., Lebanidzea B., Jebashvilia T., Maglakelidzea A. (2018). Assessment of exploitation reserves of Nabeghlavi mineral water deposit // Annals of Agrarian Science. — Vol. 16. — Pp. 352–356. — https://doi.org/10.1016/j.aasci.2018.07.003.

Kassenov A.K., Spirin V.I., Moldabekov M.S., Faizulin A.Z., Baibussinova Z.B. (2018). The analysis of modern technology and technique applied in the completion of geotechnological wells and remedial works in them // NEWS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN. SERIES OF GEOLOGY AND TECHNICAL SCIENCES. — Vol. 3. — №429. — Pp. 283–289.

Klyuev R.V., Bosikov I.I., Egorova E.V., Gavrina O.A. (2020). Assessment of mining-geological and mining technical conditions of the Severny pit with the use of mathematical models // Sustainable Development of Mountain Territories. — Vol. 3. — Pp. 418–427. — https://doi.org/10.21177/1998-4502-2020-12-3-418-427.

Klyuev R.V., Bosikov I.I., Mayer A.V., Gavrina O.A. (2020). Comprehensive analysis of the effective technologies application to increase sustainable development of the natural-technical

system // Sustainable Development of Mountain Territories. — Vol. 2, — Pp. 283–290. — https://doi.org/10.21177/1998-4502-2020-12-2-283-290.

Lu L., Pang Z., Liu J., Hu Sh., Ru S., Li Y., Lu L. (2017). Determining the recharge sources and circulation depth of thermal waters in Xianyang geothermal field in Guanzhong Basin. // Geothermics. — Vol. 69. — Pp. 55–64. — https://doi.org/10.1016/j.geothermics.2017.04.006.

Maldaner C.H., Quinn P.M., Cherry J.A., Parker B.L. (2018). Improving estimates of groundwater velocity in a fractured rock borehole using hydraulic and tracer dilution methods // Journal of Contaminant Hydrology. — Vol. 214. — Pp. 75–86. — https://doi.org/10.1016/j.jconhyd.2018.05.003.

Malkovsky I.M., Toleubayeva L.S. (2016). WAter safety of the republic of Kazakhstan. — pp. problems and decisions // NEWS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN. SERIES OF GEOLOGY AND TECHNICAL SCIENCES. — Vol. 1. — №415. — Pp. 57–67.

Marques J.M., Eggenkamp H.G.M., Carreira P.M., da Silva M.A. (2020). Origin and evolution of Cl in CO2-rich thermal and mineral waters from northern Portugal // Applied Geochemistry. — Vol. 116. — Pp. 104569. — https://doi.org/10.1016/j.apgeochem.2020.104569.

Mitrofanova A.N., Kalita R.Sh., Sharapkhanova Zh.M. (2017). Hydrogeological conditions territories of the buffer zone of the proposed "TRANSKAZAKHSTAN" channel third stage // NEWS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN. SERIES OF GEOLOGY AND TECHNICAL SCIENCES. — Vol. 6. — №426. — Pp. 80–90.

Moldashi D.N. (2021). Methods and technical solutions for keeping the path of a geotechnological borehole // Mining Science and Technology. — Vol. 6(1). — 42–51. — https://doi.org/10.17073/2500-0632- 2021-1-42-51.

Osipov S.V., Livinsky Y.N., Ermenbay A.M. (2017). Forecast resources of underground waters of the Akmola region // NEWS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN. SERIES OF GEOLOGY AND TECHNICAL SCIENCES. — Vol. 6. — №426. — Pp. 91–97.

Romanova S.M., Krupa E.G. (2017). Condition of carbonate-calcium equilibrium of water in lakes of state national natural park "KOLSAI KOLDERI" // NEWS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN. SERIES OF GEOLOGY AND TECHNICAL SCIENCES. — Vol. 6. — №426. — Pp. 139–149.

Sabri K., Marrero-Diaz R., Ntarmouchant A., dos Santos T. Bento, Ribeiro M.L., Solá A.R., Smaili H., Benslimane A., Chibout M., Pérez N.M., Padrón E., Melián G.V., Asensio-Ramos M., Carreira P.M., Jesus A.P. (2019). Geology and hydrogeochemistry of the thermo-mineral waters of the South Rif Thrust (Northern Morocco) // Geothermics. — Vol. 78. — Pp. 28–49. — https://doi.org/10.1016/j.geothermics.2018.11.005.

Saibi H., Batir J.F., Pocasangre C. (2021). Hydrochemistry and geothermometry of thermal waters from UAE and their energetic potential assessment // Geothermics. — Vol. 92. — Pp. 102061. — https://doi.org/10.1016/j.geothermics.2021.102061.

Stepanets V.G., Levin V.L., Khakimzhanov M., Savelyeva N.A., Li E.S. (2018). Problems of petrology of ultramafic rocks of Karaturgay river basin, norhtern ulytau (central Kazakhstan) // NEWS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN. SERIES OF GEOLOGY AND TECHNICAL SCIENCES. — Vol. 1. — №427. — Pp. 150–172.

Zholtayev G.Zh., Zhukov N.M., Bespayev Kh.A. (2018) The theory of forecasting and evaluating the minerals and raw materials base of the republic of Kazakhstan // NEWS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN. SERIES OF GEOLOGY AND TECHNICAL SCIENCES. — Vol. 2. — №428. — Pp. 193–200.

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