

**INVESTIGATION OF NATURAL MINERAL WATERS OF CHOIGAN COMPLEX
(EASTERN TYVA)**

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Republic of Tyva is a unique place rich in almost untouched natural resources. Variety of climatic conditions, combined with picturesque landscapes, rich flora and fauna, preserved national traditions - all this makes the republic of Tyva attractive for tourists. Nature mountainous republic is unique. Alternation of mountain ranges and plains areas, cut by small rivers with coniferous forests, give this place a very special flavor. Most of the country territory is mountainous, which determines its climate - continental with harsh winters and hot summers. It has enormous water resources, both surface and underground.

A special place in the system of water resources of Tuva is occupied by springs. In territory of republic there are more than 140 out of which more than 100 sources are used for the treatment of population various diseases [1].

The republic is rich in underground mineral waters of different groups: carbonic and nitrogen hot water, carbon dioxide and hydrogen sulfide cold springs, salty and sour water, silica, radon, arsenic, ferruginous, iodo-bromine [5]. One of the unique places in the Republic of Tuva is carbonate deposits of cold and thermal waters - "Choyganskie mineral water."

In spite of quantity and variety of such waters, this area is still poorly known due to inaccessibility, lack of qualified specialists in Tuva. Research on the geochemical characteristics and properties underground sources are not of financial support from the government. However, currently there is a trend in the republic development of therapeutic and recreational areas for some scientists and scientific organizations. It is "The Laboratory Arzhaanologii and Tourism" (Kyzyl), "The Institute of Balneology and Physiotherapy" (Tomsk), Problem Research Laboratory of Hydrogeochemistry Research-Educational Center "Water" of TPU etc.

The purpose of research is to study the formation of unique to Siberia hydrogeochemical conditions of carbonic cold and thermal groundwater natural complex "Choyganskie mineral water."

Choigan, meaning "fir", located on the north-east of the Republic of Tyva on the border with Buryatia in East Sayan, on the altitude of 1550 meters in the river valley Arzhaan Khem. In the relatively small area there are more than 50 sources, a variety of temperature and mineralization, on the content of carbon dioxide and radon. Around the sources the travertine deposits are widely developed [5].

Formation of Choyganskih sources is conditioned by a large latitudinal fault in Precambrian rocks (gneiss, marble, slate), intruded by granites and diorites Paleozoic. Unloading of mineral waters occurs predominantly on the right bank of Argens-Khem [5].

In spite of its inaccessibility, in the summer season Choigan are actively visited by tourists for medical purposes. A few thousand people relax and treat on springs every year. The places where people come from Choigan for treatment are various, but mostly they come from the Republic of Buryatia, Tuva and the Irkutsk region.

Springs are used to treat of various diseases: cardiovascular and nervous system, gastrointestinal, urological, reproductive system, musculoskeletal system, ENT diseases. Local residents gave names to springs depending on the diseases they treat, "Nerves", "From the pressure", "Kidney" etc.

Interest in Choigan springs has been shown for a long time, it was the object for study of such scientists as: S.V. Obruchev (1945), V.G. Tkachuk (1955), E.V. Pinneker (1966-1967), etc. Since the 90s complex study conducted by the Tuva Institute of Complex Natural Resources under the supervision of Dr. Arakchaa K.D. etc. In recent years the cooperation in sphere of research in the Choigan springs between Laboratory Arzhaanologii and Tourism "(LLC" ArzhaanLab ") and Problem Research Laboratory of Hydrogeochemistry, Scientific-Educational Center "Water" has been developed [1].

As part of a scientific expedition organized by LLC "ArzhaanLab" with expedition leader K.D. Arakchaa on Choygane research of physicochemical, hydrochemical, microbiological water characteristics of springs was conducted.

Hydrogeochemical study involved 33 springs, which consisted of water sampling for determining chemical, gas and microbiology composition. Comprehensive analysis of the chemical, microbiological and gas composition of water was performed in PRL Hydrogeochemistry scientific-educational center "Water".

Along with this research rapidly changing water parameters - pH, Eh, temperature and electrical conductivity were measured.

According to the research for 2011-2012, Choigan springs have hydrocarbon-sodium-calcium or calcium-sodium chemical composition; contain carbon dioxide of 5.5 mg/l to 740 mg/l. However, water mineralization varies from 0.4 g/l of the spring № 29, to 2.5 g/l in the springs № 31 and the number № 11-13. The temperature conditions of water are mainly related to the thermal - warm and hot, their temperature ranges from 20 to 42 degrees, but there is a cold spring having the temperature below 20 degrees. In the south of the valley dry gas warm funnels aerated with carbon dioxide were discovered.

Cold carbonic water has the mineralization rate lower than (700 mg/l to 1500 mg/l), but contains more carbon dioxide than hot water. This is due to the fact that with an increase in temperature and mineralization of carbon dioxide in groundwater decreases, situation becomes oxidizing [3].

Mineralization of hot and warm water is above and geochemical environment becomes reducing, temperature changes when carbonate sources of groundwater discharge. Therefore there appears a thermodynamic barrier and

deposition of calcium carbonate - travertine. Formed from travertine dome it has brown color due to the oxidation of high iron content in this section.

Also radon measurements were conducted in the sources. The concentration of radon in water springs varies widely from 1 to 155 eman/dm³. Enrichment of water with radon is apparently due to the leaching of trace radioactive elements from the intrusive body [2].

Medicinal properties of water are determined by mineralization, high temperature and content of carbon dioxide, as well as radon and other biologically active components.

Thus, according to GOST R 54316-2011 groundwater natural complex "Choigan" can be attributed to low-mineralized drinking water treatment – dining, weak carbonic waters, low and medium radon [4]. It is necessary to conduct comprehensive studies of unique natural sources because of its hydro-geochemical and medical character in connection with people's natural treatment.

References

1. Arakchaa K.D., Bukaty M.B., Karabiber S.V. Formation of chemical composition of carbonate water Choygan (Eastern Sayan) // Problems of Geology of Siberia. – Tomsk: Publ TSU, 1996. – P.2. – pp. 288 – 289.
2. Baryshnikov G.Y., Eliseev V.A Thermal treatment water of siliceous composition of the Altai-Sayan Mountains // News of Altai State University series "Earth Science". – Barnaul, 2009. – №3. – pp. 41 – 47.
3. Geochemistry of groundwater. Theoretical, applied and environmental aspects / S.R. Krainov, B.N. Rizhenko, V.M. Shvets. – Moscow: Nauka, 2004. – 677 p.
4. GOST R 54316 – 2011. Natural mineral water for drinking. General specifications. – Moscow: State Standard of the Russian Federation. – 46 p.
5. Pinneker E.V. Mineral water of Tyva. – Kyzyl: Publishing House of Tuva, 1968. – 105 p.

GEOTECHNICAL APPRAISAL OF THE SOILS IN EAST ASWAN CITY, EGYPT

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Geotechnical properties of the soils were investigated to evaluate their geotechnical behavior. Unconfined compressive strength was ranging from 1.86 to 31.7 Mpa. Grain size analysis showed that the effective diameter ranging from 0.1 to 0.2 mm and the uniformity coefficient C_u ranging from 5 to 15.5. The results of specific gravity showed that the values ranging from 1.87 to 2.2 g/cm³. Free swelling percent was ranging from 50 to 62 %. Shear characteristics had slightly difference values were ranging from 18°-25° and shear strength from 5.2 to 9 Mpa and the free swelling percent ranging from 50 to 62 %.

The main objective of the present study is the answer to the following questions: what rocks and soils are present, and how are they distributed under the site, the geotechnical properties of these soils, the chemical composition of groundwater along the study area and the effect of these composition on the soil to construct bumping water station in East Aswan city (Fig.).

The study area consists of metamorphic and igneous rocks of Precambrian age, sandstone and clay of the Nubian Sandstone series of Upper Cretaceous age and ancient gravels, sands, river sands and Nile mud of Pleistocene and Recent ages [7, 8].

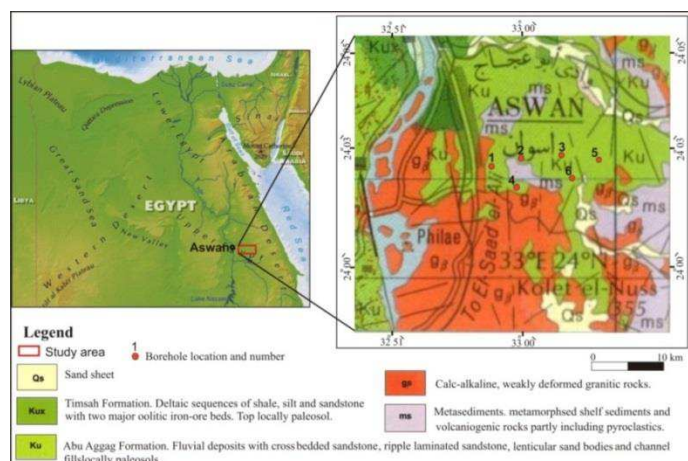


Fig. Surface geological map of the study area (modified after CONCO 1987)

Six boreholes were carried out to study the properties and thickness of different soils along the study area. The methodological approach used for the investigation and analysis of the geotechnical properties of the soils, five geotechnical tests including grain size analysis, specific gravity [3], unconfined compressive strength, shear strength [4]