

Hydrogeochemistry investigation of karstic sources Khorramabad area, Lorestan province, Iran

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Abstract

The studied area lies 33° 25' - 33°33' N and between 48° 15' - 48° 50' E and located in Folded Zagros Zone.

The investigation of chemical quality based on chemical analyses different water resources under ground of drinking water in Khorramabad area show that these sources are good quality (with the exceptions of Tir square that have high content Arsenic, 27mg/lit) and suitable for agriculture and drinking consumptions.

Lithological exact investigation implies that geology formations in this area different from based on hydrogeology characteristics.

The purity percentage of carbonates in upper cretaceous rocks (Bangestan carbonate formation) shows that these rocks have primary and secondary porosity.

The primary porosity has low effect of karst formation but secondary porosity is basic factor in karstic formation. So, tectonics conditions and faults are basic influence in karstic bed, caves that was canal for passing ground water.

Indeed in parts of dolomitizations occurred, carbonates rocks have high thickness and ground water increase in these beds.

Occurrence of different spring to high Debby in these rocks (Motahari, Golestan, Falakedin and Poshte carbonate wells) imply that rocks in this area are mature Karstic.

To attention of cap or contact rocks formations (salty- chalky Gachsaran and Asmari) these karstic resources carbonate are damageable of quality for resources water.

Key words: Khorramabad, Zagros, karstic, Arsenic, Asmari

Introduction

Nowadays the access to sweet and safe water is one of great problems for human-beings; therefore, the function of karstic water, which enjoys favorable quality, is undeniably significant in fulfillment of human requirements, and the water resources in our country are considered as strategic richness for our strategic needs, regarding recent droughts. Therefore, due to criticality of karstic resources in supplement of water either for drinking or for culture, also due to vulnerability of these valuable resources against polluting elements, it seems necessary to take the maintenance and preservation of the karstic resources into account. The natural polluting elements, result the geological structure of the area, can be mentioned as the

most important elements corresponding to the pollution of karstic water resources. Hence, now the karstic water resources in Khorramabad are studied here.

Stratigraphy and geological setting

The studied area is located between 48, 15' & 48, 50' E, and 33, 25' & 33, 33' N (Fig 1). Placing in Zagros Folded Zone geologically (Stocklin, 1968), it has such a normal and balanced condition tectonically (Berthier et al., 1974) that the sediment is aggregated with uniformed stratification according to the age, and there are no particular phenomena excepting the presence of numerous folding and faults in internal parts of formations (James and Waynd, 1965). The emergence of some streams can be corresponding to these sills. The oldest rocks of the area are including limestone, belonging to upper Cretaceous age. The limestone respecting time and place belongs to Bangestan group or it is equivalent of it, and with a sudden contact, it is placed under the Amiran conglomerate.

Amiran formation is consisted of two distinct sections in Khorramabad: one is the section of conglomerate with thick stratification called informally Khorramabad conglomerate, because of its rather high development in the area. Another one is the sandstone-shale section, which is from one kind of very tiny – grained calcic shale placed under the Kashkan conglomerate.

Kashkan formation, in the age of Paleocene to Eocene is consisted of conglomerate, sandstone and red marl along with layers of limestone in the middle of rocks, whose red marl generally are seen as red soil. Asmari formation in the age of Oligocene to beginning of Miocene is consisted of limestone with tiny texture and including very small and sometimes microscopic holes in the studied area. The limestone is placed under sedimentary units of Fars group in the shape with common slope and with tectonic contact, which is the result of huge fault functions or folding as stalactites and stalagmites. These contacts are particularly important in exchanges and connections of karstic water resources.

There are units formed by sandy lime, sandstone, tiny – grained conglomerate, marl, chalk, anhydrite in the age of middle to upper of Miocene on top of Asmari formation. These sedimentary units belong to Fars group regarding the characteristics of the units, as well as, the situation of their settlements upon Asmaric formation. The similarity between the accumulation of sedimentary units and units of Gachsaran formation is rather minuscule; however, it seems more similar to the sedimentary units of Razak formation.

Hydrology of the formations

Bangestan and Asmari formations are from the most significant formations, being in the area, respecting the amount of their water and the amount of their water output. They are constructed of stony units from limestone and dolomite, and they show their potentiality of forming layers of sweet water, whenever they are changed into karsts, and the holes, breakings, slits and gaps are developed aggregately (White, 1977), but their potentiality is too minute and, they have reduced to be as Shales and the other tiny–grained stones, whenever the rocks are as the form of solidarity without slits and holes, and the dissolvent vessels are not developed in them. The thickness and the development of carbonate rocks are, also, effective in the amount of available underground water in them; therefore, wherever the carbonate rocks have more thickness and regional development, they have more water, and whenever they have less thickness and development, they usually form small water tables. In

addition, in some parts where the phenomenon of the development of dolomite and faulting has taken place, the amount of available underground water has increased, because the porosity of carbonate rocks has increased. The upper Cretaceous lime stones (lime Bangestan formation) in Khorramabad area (Khorramabad anticline) from a hydrologic viewpoint have two kinds of primary and secondary porosity, that primary porosity have little impact upon the production of Karst, but their secondary porosity play the greatest role in the production of it, so as the tectonic elements and the faults have a great impact upon the production of the karstic bands and holes and caves in these rocks, which are the place for accumulation and passage of water (Aghasi, 1999). The phenomenon of karstic has developed considerably in lime Asmari formation, because of the presence of great amount of slits and holes and so much porosity especially secondary porosity and there are a lot of outward visible testimonies of karst; this formation has caused the production of underground flowing among the limestone, because of high percentage of carbonate and the vast development of it in the Folded Zagros Zone and rather evolved karst in it. In some parts of the studied area where Asmati formation is covered by salty – chalky formation, it has a great negative impact upon the water resources being in it; however, in the other parts where it is covered by the form from chiefly marl and sandstone, it has less effect upon the quality of Asmari water resources. In addition to the limestone, Amiran conglomerate and Kashkan conglomerate have formed, also, the layers with water in them, whenever they lack complete cement or cement with a lot of holes and slits; however, in the formations whose lithology are chiefly from moraine with chalk, anhydrite, and salt, the amount of water output are weak because of the development of tiny – grained sediment, and the underground water tables are seldom formed in them, which do not have favorable chemical quality and are usually salty.

Hydrogeochemical of the water resources

Here it is dealt with the determination of physicochemical quality of karstic resources, the effect of geological formations upon the quality of water resources and the determination of the limitation of water consumption both for drinking and culture. The study and analysis of chemical quality of the karstic water resources is dependent upon the chemical results of the last picked up samples of water during the research, some parts of which have been carried out in Lorestan organization of water and the other parts performed by Kermanshah nuclear absorption system. Since the analyses of chemical quality of water have its own complexity, the displaying techniques of qualitative water conditions are used for facilitation to access them. Sholer diagram is used for displaying the condition of drinking and Wilcox diagram is used for displaying the condition of cultural consumption of the area's water.

As mentioned, there are two karstic reservoirs of Asmari formation and Bangestan formation in the studied area. Based upon the chemical results of picked up water samples, the conditions of the studied water have been shown by Sholer and Wilcox diagrams (Fig 2, 3). From drinking viewpoint, they are put from good to acceptable water (Fig 2) and due to having low sodium percentage (%Na) from excellent water and from cultural viewpoint are in the class C2S1 and some C3S1 (Fig 3). PH of the water samples is as the minimum level 7.2 and the optimum of PH 7.4 and the optimum amount of Ion of choler 2.4 mg/lit, and the minimum amount of insoluble solid materials (TDS) are 202 mg/lit, and the maximum of

them are 888 mg/lit, which are reduced during the flowing. Total hardness (TH) is, also, as the minimum level 170 and maximum level 332 according to CaCO₃.

The calculation of the amount of mercury and arsenic in the water samples (except Meidan-e Tir well which has a considerable amount of Arsenic 0.87-4.33 mg/lit), Chrome (5.96-14.15 mg/lit), Copper (0.6-3.97 mg/lit), Zinc (6.97-103 mg/lit) of them are in the standard level and they are not problematic to be drunk. However, the water of Meidan-e Tir well, because of having so much arsenic due to being poisoned by this dangerous element can have hazard for dweller of this part of Khorramabad, so as 0.1 mg of arsenic trioxide can cause people to die. Also, being so much in drinking water and food, this element can cause skin cancer and a lot of kinds of cancers of internal parts of body such as; bladder, kidney, and lung. (Ghazban, 2007).

Results

There are two karstic reservoirs in the studied area: Asmari reservoirs and Bangestan carbonate unit reservoirs. These carbonate resources and reservoirs are qualitatively vulnerable due to the kind of the covering or contacting formations, in fact, Fars group formation is observed as a polluting, harmful, and adverse formation for area's karstic water. The water of the area's wells (excepting Meidan-e Tir well because of high amount of arsenic) has high quality, and does not have any limitation for drinking and cultural uses.

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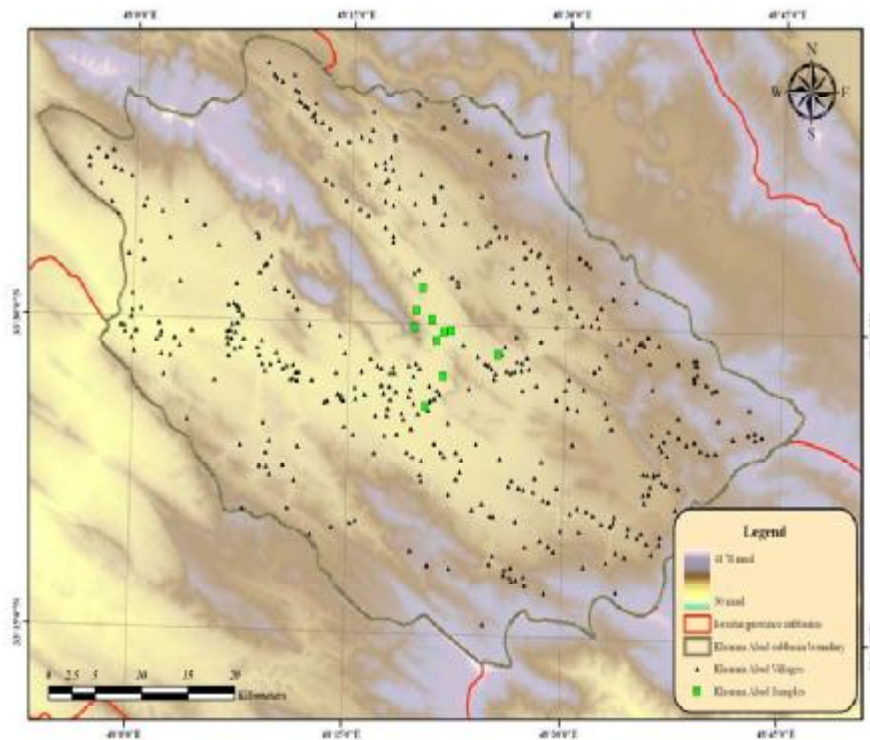


Figure 1: The geographic situation of Khorramabad and the places of the studied area water resources

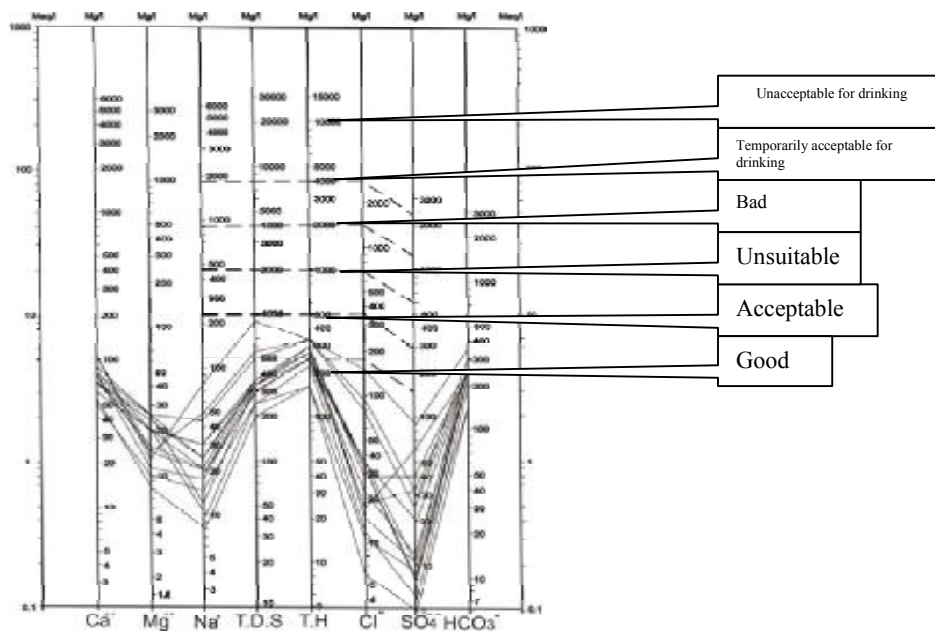


Fig 3: The chemical result of complete analysis of qualitative water resources in Khorramabad, which shows that the water is from good to acceptable from drinking viewpoint.

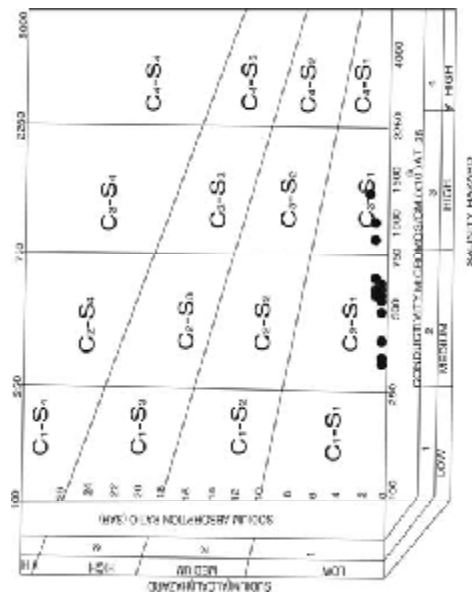


Fig 3: The chemical result of Khorramabad resources which shows that the water is from excellent classes from cultural uses viewpoint respecting having low sodium percentage, placed in classes C2S1 and C3S1.