Tectonic Control on the appearance of Karst springs in kooh-e- Siah (Dehdasht, southwest Iran)

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Abstract

Kooh –e–Siah Karst System, situated in Zagros belt is developed in deformed limestone layers of Cretaceous and Oligocene age. The faults and joints have been of important role for the development and the evolution of the karst system. These joints are controlling the principal direction of the karst galleries and the draining of the ground waters. The ground water flow is discharged by several relatively big karst springs (Koorsa, Pirzal, Moger, etc). The purpose of this research to evaluate the role of tectonic control on hydrogeological characteristics of karstic aquifers in Kooh-e-Siah anticline. The volumes of dynamic resources of karstic springs are calculated in order to illustrate the basic relationship between Tectonics phenomena and karstic aquifers hydrogeology.

Key words*: karst, spring, tectonic, Kohgiloyeh&Boyerahmad*

Introduction

The term karst, in addition to its geological meaning, is usually used as a synonym for barren rocky terrains (Shanov S., Benderev,1986). While nonkarst geological terrains have been utilized successfully in the construction of large hydro projects including dams and reservoirs and water supply and irrigation projects, karst regions have been considered unsuitable for the development of similar projects. This is due to the complex geological features and unique hydrological characteristics of karst rock formations, consisting mainly of limestone, dolomite, gypsum, and halite. Solubility of these rocks plays a major role in forming the karst terrains with complex geological and hydrogeological characteristics. However, an increased demand for drinking water, land reclamation, and energy has gradually changed the engineer's attitude toward the use of karst regions (Milanovic.P, 2005).In the past few decades, many water resource projects have been successfully developed in countries with large karst regions, such as Bosnia and Herzegovina, China, Croatia, France,Greece, Iran, Italy, Russia, Slovenia, Spain, Turkey, the United States, and Yugoslavia(Milanovic.P, 2005. Nevertheless The Province of Kohgiloyeh & Boyer Ahmad with an area of 15,563 square kilometers is located in central southwestern Iran (fig 1).

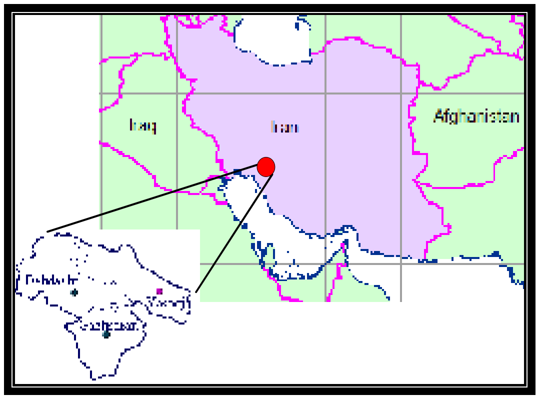

Fig.1: Location map of the studied area

One of the most important cities of this province is kohgiloyeh (with its center as Dehdasht). This province is located in Zagros belt and holds many diverse morphological features with accommodates will with its geological characteristics. The areas northwest and northeast and southeast of this province are composed of continuous high mountains range such as Dena, Mongasht, Delafrooz, Khami, Nil, Kooh-e- siah, kooh-e-sefid and Khaeez with deep incised valleys, while south and southwest part is Characterized by existing intermountainous plains like Kalacho and Imamzadeh jafar and Basht and others which are irrigated by ground water and karstic wells and springs. One of the most important karst aquifer in this area is karst aquifer of kooh-e-siah anticline. This karst aquifer has many relatively big karst spring sach as Koorsa, Pirzal and Mooger. This anticline is located northeast of dehdasht city in southwest of iran (Fig 2).

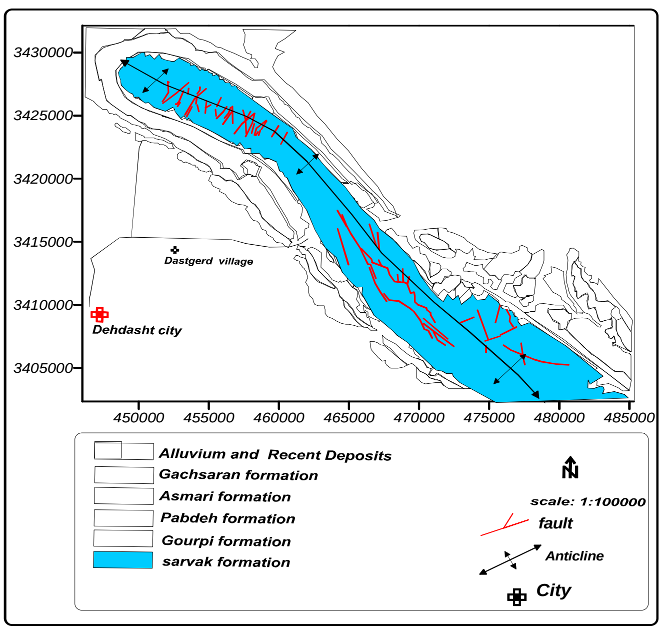

Fig 2: the geological map of studied area within outcroup of Bangestan group formations. The kohe siah anticline includes many of Fars group formations such as Sarvak, Gourpi, Pabdeh, and Asmari formation from Fars group. Also there are many faults in this anticline. (Geological survey of Iran)

Geology and startighraphy

The Zagros orogenic belt of Iran is the result of the opening and closure of the Neo-Tethys ocean realm along the northeastern border of the Arabian plate (Berberian and King, 1981; Alavi, 1994). The Zagros consists of a thick sedimentary sequence that covers a Precambrian basement formed during the Panafrican orogeny (Al-Husseini, 2000). During the final extensional stage, in the latest Precambrian, a thick sequence of terrigenous clastics, carbonates, and evaporites accumulated over a large area **(**Sherkati, S., and Letouzey, J., 2004**).** The Zagros mountain ranges dominate southwestern Iran. The sediments exposed here are generally of Mesozoic age. The intensity of folding gradually decreases towards the Persian Gulf where younger rocks are seen in outcrop. eographically the Zagros Mountains belong to the Alpine-Himalayan chain, but clearly do not fit into models for the Alps or Himalayas (Takin, M., 1972). Some of these difficulties were discussed by Stocklin (Stocklin, J., 1968), who concluded that Iran had a peculiar type of Alpine tectonics. Cretaceous marine sediments exposed in several localities in the Fars basin of Sw Iran. The middle Cretaceous in the Zagros basin is represented by two types of faces:

The first type is exposed at Fars and Kohgiloyeh &Boyerahmad, Where middle Cretaceous sedimentation began with deposition of shallow water limestones (Kazhdumi Formation) and continued through most of Albian time. This Formation lies uncomfortably on the Dariyan Formation. The upper boundary of the Kazhdumi Formation with the overlying marly thin bedded limestone of the Sarvak formation is an unconformity over the greater portion of Kohgiloyeh &Boyerahmad province, northeast Dehdasht and The second type of middle Cretasceous succession in the Zagros basin is found in Lurestan, where the middle Cretaceous is represented by dark, grey to black radiolarian bearing shales and argillaceous limestones of deeper water origin Garu Formation (Fig3).

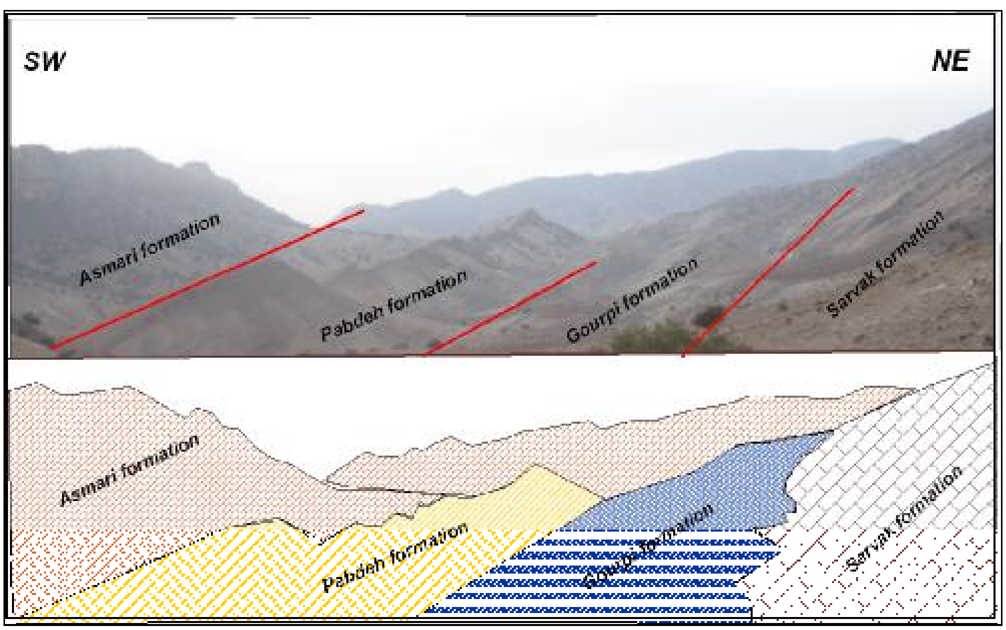

Fig 3. The schematic map base on photo of studied area. This map shows statighraphy of Kohe Siah Anticline. (Photo by Shafiei Motlagh)

Sarvak formation is oldest formation that outcrops in core of Kohe siah anticline.erotion roughs face of limestone rocks of this formation and Karstification process visible in overall of it. Joints system extremely developments in overall of this anticline especially above the appearance of karst spring such as Koorsa and Tange –Pirzal and Mooger. There are sixteen deep wells in this range. The age of this formation is cretaceous (albian cenomanian). This formation contain massive gray to dark gray limestone. Blue gray Marls and marly limestone of Gourpi formation located on sarvak formation with disconformity. The age of Gourpi formation is upper cretaceous .remarkable that the Koorsa spring flows in contact Gourpi and sarvak formation but the Mooger spring directs by a fault and flows between gourpi and pabdeh formation.interbeddded grey marls and marly limestone of pabdeh formation situate on gourpi formation. The age of pabdeh formation is Eocene and probably Paleocene. The contact of pabdeh and Asmari formation is gradually. Asmari formation in this area contains massive, porous and cream limestone. The age of Asmari formation is Oligocene and early and middle Miocene (fig 3).

Discussion

Karstification is a result of water penetrating into permeable and soluble rock masses.

Solubility and permeability are equally important factors. The basic factor of Permeability in the carbonate rock mass is jointing. Limestone and dolomite rocks are very brittle, especially if they are thick layered, benched, and massive. Intensive tectonic processes will produce extensive joint systems that provide access to water that can migrate into deeper sections of the thick rock mass. There are two types' faults in kohe siah anticline (FIG 4) these faults have especially strike and dip so those effects on appearance of different springs. For simplicity study we classified these fault to two group, A group and B group. The A group have NE-SW strike and 90 degree dip direction. The B groups have NW-SE strike and 35 to 45 degree dip direction.

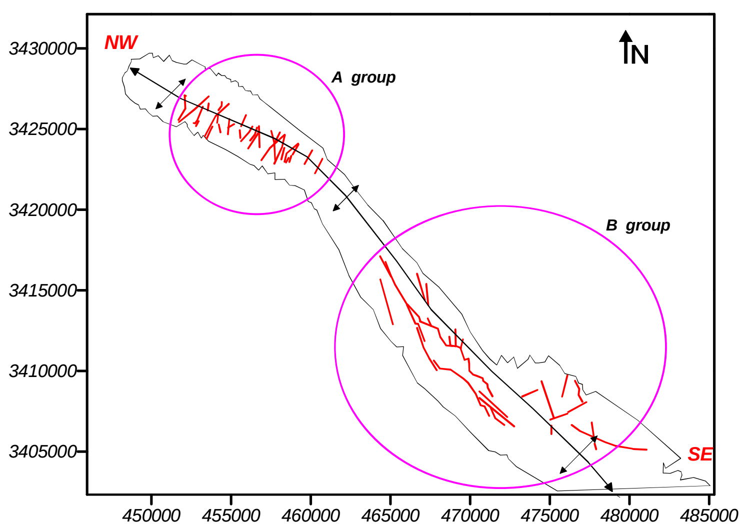

Fig 4. The map of two types fault in kohe siah anticline

The effect of these faults cause appearance many spring at contact sarvak and Gourpi formations (FIG 5).

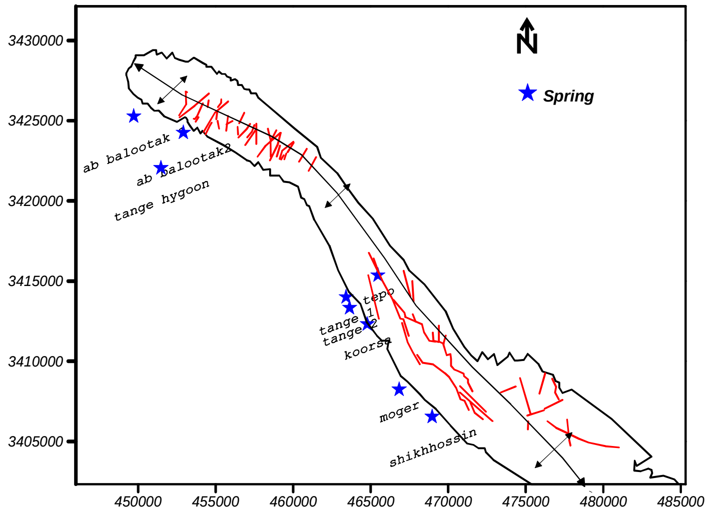

FIG 5. The map of location of spring in foot of Kohe siah anticline.

According the map of (FIG 5) there are 10 springs in foot of anticline. Apiece of these springs have especially discharge. it seems there are two types springs. First group possessor low discharge (about 3 to 5 litters per second) such as Abbalotak 1 and Abbalotak 2, Tang-e -Hygoon. Second group with high discharge (about 8000 litter per second) such as Koorsa, Tang-e-Pirzal, and Mooger springs. Also there are 16 wells in this area. Whole of these wells drilled in amplitude of A group faults and there are not any well around or near B group faults (FIG 6).

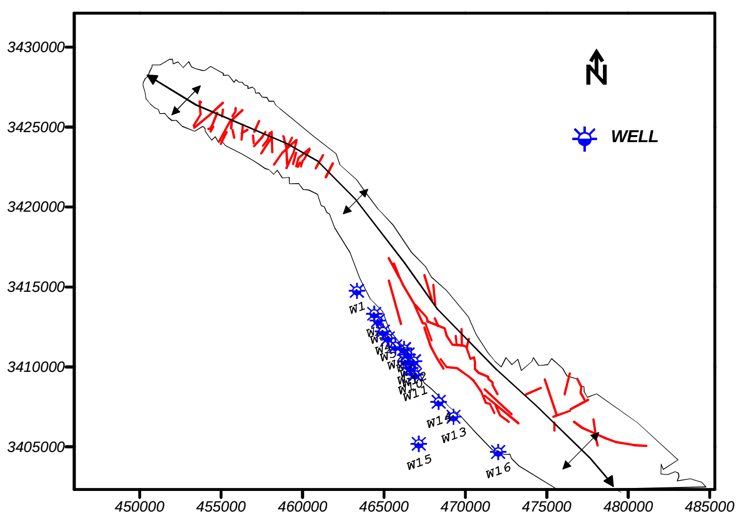

Fig 6. The map of location and frequency of well drilled in karst aquifer of Kohe siah anticline.

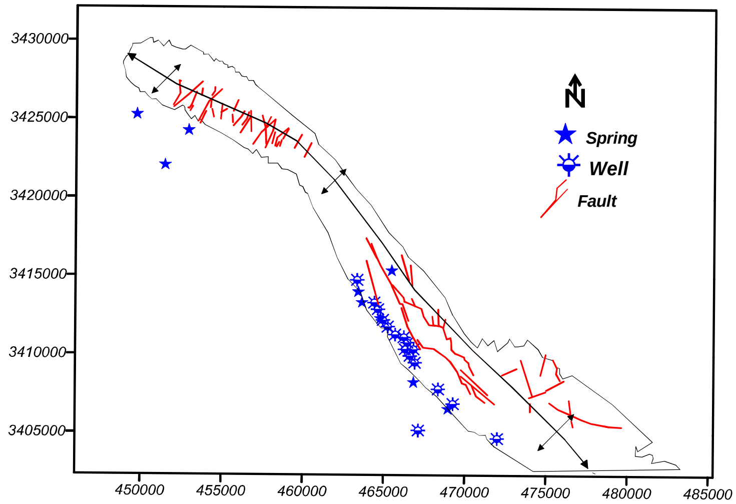

FIG 7.The overlay maps of springs location and wells location.

Its very interesting that the overlay maps of springs and wells locations shows to us. Because we can see the effect of tectonic control on appearance of karst spring and discharge of them and limestone wells and discharge of them. Actually there is a meaningful relationship between fault position and springs location.

Conclusion

One of the most important water resources in many countries especially Iran is karst aquifer. The Kohe Siah anticline karst is the most important and biggest karst aquifer in Dehdasht area situated in southwest of Iran. There are 10 springs and 16 well in this area. The biggest springs such as Koorsa and Tang-e- Pirzal and Mooger sprigs located close together. It seems existence a set fault with NW-SE trend and 35 to 45 SW dip direction caused it. Zones where two or more faults come together or intersect (e.g., along shear zones) are the most susceptible to karstification. However, the most spectacular increases in yield were noted for carbonate rocks located in valley settings where karstification tends to be more intense. Joints, bedding plane openings, faults, and fracture zones cause increasing porosity in karst system. This promotes increased infiltration and solution attack of the underlying bedrock along the same secondary tectonically induced openings that localized these surface depressions to start with. The high discharge of wells in Kohe siah anticline amplitude shows and supports this action.

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