GEOLOGICAL CHARACTERISTICS OF TEHRAN AQUIFER

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Abstract - The alluvial deposits of Tehran is composed of up to 1100 m and is divided into five parts: The first part (~500 m) has been denominated as first member of Hezardareh Formation and has been formed of hard conglomerate of Upper Pliocene age. This part has many few porosity, high erodibility of pebbles and strongly cementation.

The second part (second member of Hezardareh Formation has been composed of ~500 m of incoherent conglomerate and conglomeratic sandstone deposits of Lower Pleistocene age. This member has highly porosity respect to first member and less grade of erodibility.

The third horizon (Kahrizak Formation) with 10 to 60 m of thickness contains pebble, gravel and sand. It is Middle Pleistocene in age.

The fourth stage (Tehran alluvium) with 50 m of thickness has been formed by stratified gravels of Upper Pleistocene age. In general this Formation is composed of heterogeneous grains and because of having frail cement between pebbles it is permeable and with relatively high mechanical resistance. Tehran alluvium has been the better depository of underground water in the alluvial fan of Tehran region.

The fifth part (Holocene stage) with 1-5 m of thickness contains coating pebbles, gravel and fine sediments. It is composed of separated and highly permeable deposits, which its mechanical resistance differs in different part of the region.

The thickness of alluvial aquifer is estimated about 300-350 m, which composed of second member of Hezardareh and younger Formation.

Much of the groundwater essential to agriculture and human existence emanetes from aquifers in Quaternary sediments of Tehran plain.

According to our surveys and data, annually water consumption of Tehran city is about 700 million meter cubic which 20.8% of it discharges from Quaternary deposited sediments.

Key words: aquifer, groundwater, Tehran region

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INTRODUCTION

The Quaternary deposits comprising semiconsolidated to unconsolidated gravel, sand, silt and clay, occupy the greatest part of Tehran plain. These deposits have been used for example in construction aggregates for the residual, industrial and transportation segments of the population, ceramic clays, and laterites.

Much of the groundwater essential to agriculture and human consumption extract from aquifers in quaternary sedimentary environments.

Study area

The Tehran city is situated in Tehran province at the central Iran southern part of Alborz range, covering an area from latitude 35^{o} 35' N to 35^{o} 50 N and from Longitude 51^{o} 15' E to 51^{o} 35'E. Location map of Tehran plain is shown in figure 1.

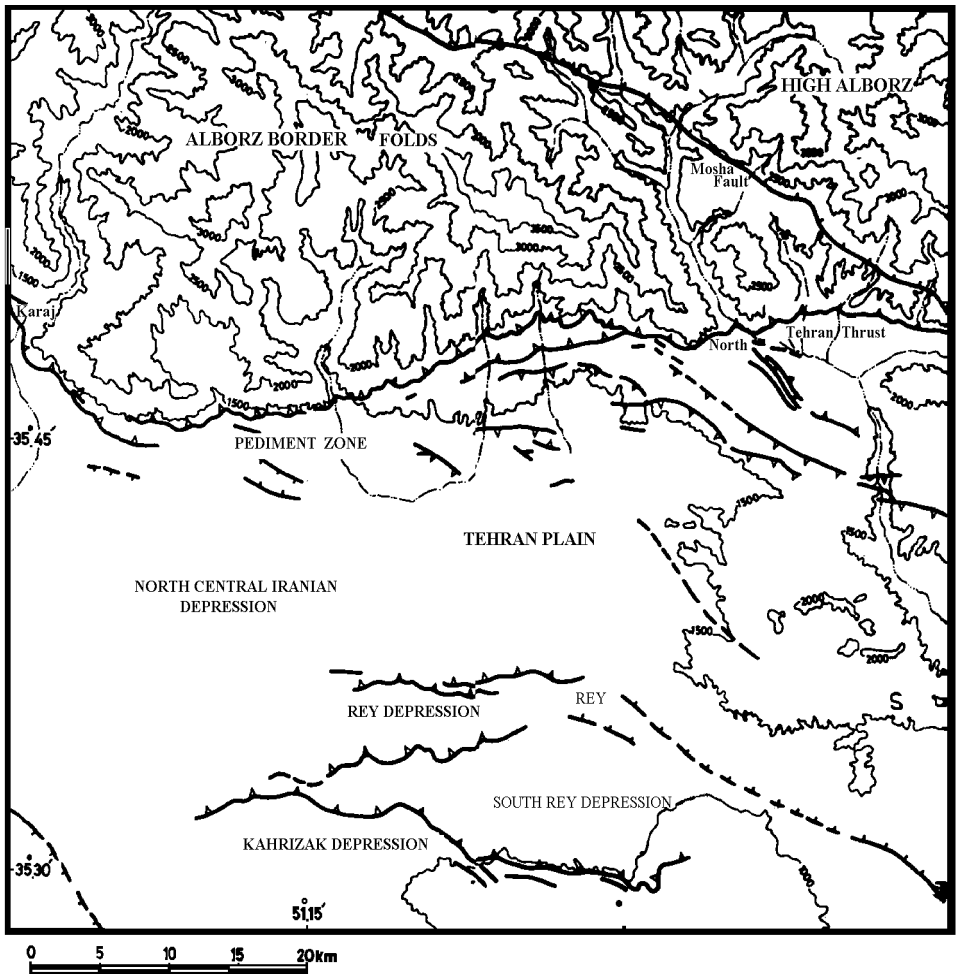

Figure 1. Location map of Tehran plain.

Discussion

STRATIGRAPHY

The Quaternary sediments of Tehran region were studied during the recent 15 years. On the basis of the stratigraphical and sedimentological development of the Quaternary deposits, the region can be divided into the following formations:

Hezardarreh Formation

The type section of Hezardarreh Formation is situated at the western part of Jajrud and eastern part of Tehran. The thickness of alluvial sediments of Hezardarreh Formation is ~1000 m and forming a long anticlines in the along to Alborz range.

The Hezardarreh Formation in the aspect of petrology has been composed of conglomerate.

The distinguished characteristics of Hezardarreh Formation are:

-High thickness

-Homogeneous

-Regular stratification

-Pebbles with medial size

-Advanced grade of weathering

-Grey in color

-High slope of layers

-There are semi rounded grain results from Karaj Formation (90%) and another rocks (10%).

Which indicate duration of sedimentation of Hezardarreh Formation uplift and erosion of Alborz mountain. Alluvial Hezardarreh Formation overlaying Upper red Formation (Pliocene). Gradually in the Ivanaky region. In the upper part of Upper red Formation which is composed of marl and red sandstone, exists so much conglomeratic layers, which indicate existence of torrential environments and to come up Alborz mountain and beginning of deposition of Hezardarreh Formation. Hezardarreh Formation is divided in two members [1]. The first member of Hezardarreh Formation has many few porosity, high erosion of pebble and strongly cementation. The second member of it has highly porosity respect of first member and less grade of erosion of pebble. Hezardarreh Formation after folding, faulting and intense alternation, overlaying by Kahrizak Formation.

Kahrizak Formation

The Kahrizak Formation in the type section overlaying Hezardarreh Formation unconformity that corresponding to tectonic phase of Passadenian and has been covered by Tehran alluvium. The presence of great altered and heterogeneous fragments of rocks in the basal part of formation may be indicating influence of glacial transport. The environmental deposition of this formation is probably fluvioglacial. Under this formation exist some lateritized layers, which indicate climatic variation during the deposition. The thickness of Kahrizak Formation is varies from 10 to 60 m.

Kahrizak Formation has different characters from layer to layer because of having heterogeneous, mechanical resistance and changeable porosity.

The distinguished characters from Hezardarreh Formation are:

-Unsolidificate, heterogeneous and poorly sorted conglomerate.

-The gravel size is ranging from several cm to several m and has been situated in sandstone cement.

-Having feeble cement and little mechanical resistance.

-The slope of layers is few and reach maximum to 15.

-The darkness color of Hezardarreh Formation.

Tehran alluvial Formation

Tehran alluvium Formation including younger alluvial fans, which from southern pediments of Alborz Mountains continue to south and spread part of Tehran city, has been built on it.

This formation in general is created by alluvial and stream sedimentations. The thickness of them is up to 50 m. The homogeneous sediments are composed of gravel, sand, silt and boulders. Species of stratification has been seen on the unconsolidated sediments. The presence of re conglomeratic layers laterizaed and weathering surface indicate the suspension of sedimentation. The layers of this Formation have horizontal aspect and have not supported tectonic movements. Tehran alluvium Formation overlaying Kahrizak Formation and has been covered by Holocene alluvium. These alluvium sediments have been formed by erosion and resedimentation of Kahrizak Formation.

Holocene alluvium (Recent alluvium)

Holocene alluvium has been composed of the youngest unit of stratigraphycal section of torrential and stream deposits of postglacial [2]. This formation overlaying Tehran alluvial Formation and the boundary has been formed by a red laterized horizon. The thickness of Holocene alluvium is 1 to 5 m. The sedimentary processes, which have been effectively in the formation of these alluvium sediments, are sheet flood.

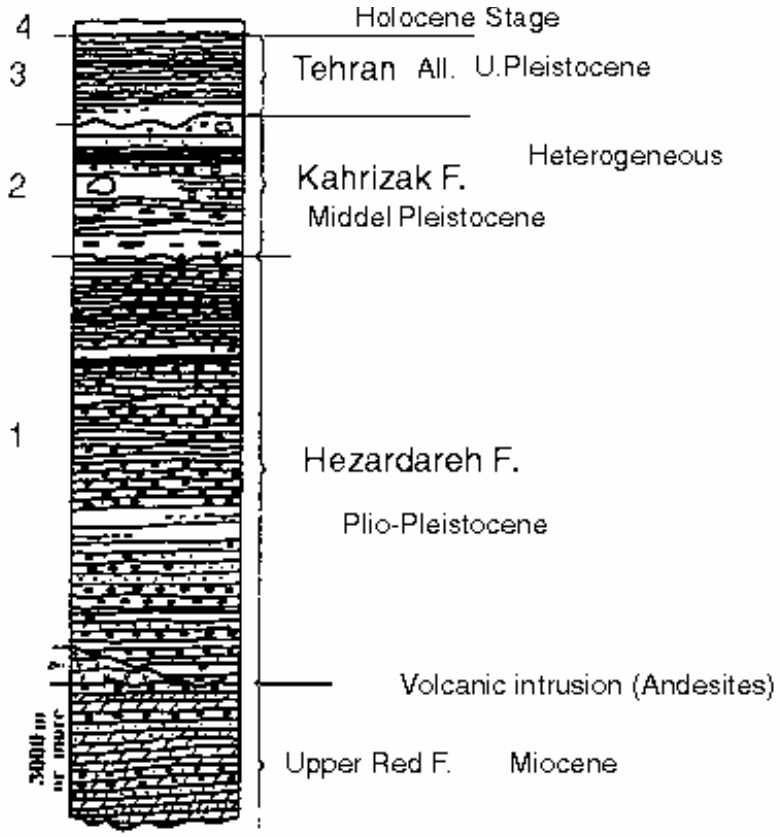

Figure 2. General section of Quaternary deposits of Tehran region.

Hydrodynamic and hydrological characters of Tehran Alluvium

The thickness of alluvial aquifer is estimated in Tehran region around 300 to 350 m, which composed of second member of Hezardarreh Formation and younger Formations. (The general office of groundwater, 1971).

In general, Tehran Alluvial Formation is composed of heterogeneous grains and because of having frail cement between pebbles is permeable and with relatively high mechanical resistance. Tehran Alluvial deposits, in the better underground water in the alluvial fan of Tehran region. The better originally alluvial fans in Tehran region from west to east are Karaj, Kan and Jajrud.

The Recent alluvium (Holocene stage) is composed of separated and highly permeable deposits which its mechanical resistance differs in different parts of region.

Aquifer character

Water of Tehran city has been prepared from surface water such as: Karaj, Jajrud, Lar rivers and aquifers. Extracted water from Tehran aquifers quantitatively is equivalent to 20.8 percent of total consumption water. From this amount, 10.5 percent equivalent to 63.4 million cubic meters has been extracted from wells and 10.3 percent; equivalent to 62.6 million cubic meters has been extracted from groundwater.

The level of groundwater in the different parts of Tehran is situated at the various depths and regard to measured rainfall in the surface of 600 to 800 km^2 of area, durability of snow on the glacial summits and watershed of Tehran from northern part towards to the top of Shemiranat and Tochal alluvial fans level of groundwater is very down or is not visible in the hard formations.

In general the wells have been situated lower than 120 m. Pisometric levels are sit heighten in the central part of Tehran gradually. In the southern part of Tehran, at the limit of Rey city to Behesht-zahra area the depth of Pisometric levels reduces to minimum depth and comes near to the surface.

ECw of the groundwater in the central part of aquifer is changing from 0.3 to 0.4 ds/m. At the southeast region of the studied area, the ECw has been increased up to 1.2 ds/m, in the other hand, at the north-northwest direction the amount of the ECw has been decreased to 0.6 ds/m. At the north part of Tehran, ECw is about 0.8 ds/m and at the northwest of studied area, ECw has been increased to 2 ds/m.

CONCLUSIONS

The Quaternary sediments of Tehran area are drawn considering the geology and other physical processes occurring in the investigated area.

- The mapped area consists of four quaternary geological units, as follows:

a) Channel deposit

b) Natural levee deposit

c) Floodplain deposit

d) Flood basin deposit

e) Abandoned channel deposit

Floodplain deposits cover the major part of total mapped area.

-Four geological units (Formation); each have a different type of vertical section of sediments.

- All the deposits of the area are fluvial in origin.

Chemical quality of Tehran's water is very good, because of geological and petrological effects.

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