ORIGIN AND SOURCE OF SPRINGS WEST. IRAQ

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ABSTRUCT

Springs are Creating when the water table intersects the land surface and water flows onto the surface. Springs considered the main water for human living, when the surface water is rare or unavailable. This research is a trial to find the source and origin of Hit-Kubasa city springs (W-Iraq), and the relationship between springs and ground water. Springs are found at the eastern edge of the western desert, and extended to about 20 kilometer from Hit to Kubasa city. Hydrochemistry of the springs Shows high salinity and very hard water. Water type of Hit-Kubasa springs is Mg-Ca-Na-chloride. The origin of sprigs is marine origin. Also the springs are Cl-Ca water type.

According to Sulins (1975) classification , water springs reflects the marine origin of water bearing formation and long period of marine deposits, so the marine water have been subjected to different diagenetic processes. Source of Hit-Kubasa springs is marine water that has been left during the deposition.

Key words: Springs , West. Iraq

أصل ومصدر الينابيع- غرب العراق

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الخلاصة

تنشا الينابيع عند تقاطع منسوب المياه الجوفية مع سطح الأرض حيث تجري المياه أو تنضح فوق سطح الأرض.
تكون الينابيع المصدر الرئيسي لحياة الإنسان عندما تكون المياه السطحية شحيحة أو معدومة.
يهدف البحث إلى إيجاد أصل ومصدر مياه ينابيع منطقة هيت-كبيسة الواقعة في غرب العراق وكذلك إيجاد العلاقة بين الينابيع وخزانات المياه الجوفية الموجودة في منطقة الدراسة.
تتوزع ينابيع منطقة الدراسة في الحافة الشرقية للصحراء الغربية وعلى امتداد حوالي 20 كيلومتر من مدينة هيت إلى مدينة كبيسة.
بينت الدراسة إن مياه جميع الينابيع ذات ملوحة عالية وعسرة جدا وان مياهها من نوع مغنيسيوم-كالسيوم-صوديوم-كلورايد، وان مياه جميع الينابيع من أصل بحري وقد عانت لفترة طويلة جدا من عمليات تحول في أحواض الترسيب البحرية القديمة.

كلمات مفتاحية: نبع ، الغرب العراقي

INTRODUCTION

Spring is natural flow on earth surface to form water pond or small river, depending on the quantity of spring water. The water quantity of springs is different from season to another that means, springs water is being much during rainfall and ice melting, while it is little during summer season (Christopherson.2009).

Spring formation is result of being pores and permeable layer contains water (Aquifer) is over another impermeable layer (Thompson. and Turk.2007)

During the flowing of ground water by way of water table, the intersection between water table and earth surface is creating spring.

Springs are creating by many way such as, cracks, faults and other geologic structures (Keith, Sverdrup, and Virginia,.2008).

Springs are important resources for human population especially when the surface water is rare or absent. Springs are affected by many agents such as:-

1-Permeability of rock forming formation (Aquifer).

2-Size of aquifer and quantity of ground water.

3-Kind of rock consist aquifer (high or low pores).

4-Structural features like faults, folds and surface topography in earth surface (Plummer and Carlson, and Geary, 2007).

One or more of above agents may be forming natural spring Figure 1.

The aim of research is to find the source and origin of springs at Hit-Kubasa area Figure 2.

FIELD AND LABORATORY METHOD

Thirteen water samples were collected from Hit-Kubasa area (April.2004), to find the concentration of major elements. Many methods of analytical chemistry are used (APHA, AWWA, WPCF. 1975)

RESULT AND DISCUSSION

1-Hydrochemistry of springs:

A-Natural Properties of Springs Water:-

The color of spring's water is light blue to light green, with disagree smell of dissolved hydrogen sulfide. the temperature of sprigs water is between 22-32 C^o .

B- Salinity and Electrical Conductivity:-

The relationship between salinity and electrical conductivity is shown in Figure 3.

B.1-Salinity of springs is between 2620-31075 ppm.

B.2-Avarage of Salinity for water springs is 8359 ppm.

B.3-Electrical conductivity is between 2.2-18 milliohms/ cm, and the average is 6 millimhos/cm.

B.4-Water of springs is Brackish to Saline according to classification of (Davis and dewiest 1966).

Table 1 is show the total dissolved salts and the majors ions in the springs, while the aquifers in the studied area and sea water is shown in table 2.

2-Chemical Formula For Springs Water:

The chemical formula for Hit-Kubasa springs is represent on Bar Diagram, as epm% for major cations and anions (Dickey.1966) Figure 4.

The average of hypothetical salts dissolved in spring's water as epm% is:-

	HCO_3	SO_4	Cl		
	4.1	6.8	89.1		
Salinity (8.4)	----------				PH=6.8
	Ca	Mg	Na	K	
	26	16.8	50.5	4.7	

3-Origin of Springs:

The chemical composition of ground water is a function for a chemical, physical, host rock and many geological Agents, which is result the type of underground water. These agents may be lead to fresh, brackish or saline water (Ivanov., Barbanov., and Plotnikova., 1968). Depending on the origin, ground water is divided into:-

3.1-Meteoric water.

3.2-Marine origin.

3-2-a-Water of marine deposit.

3-2-b-Remaining of saline water (deposits basins).

Regard the chemical ratio (rNa/rCl or rNa+rK/rCl) is good chemical mode to differentiate between marine and meteoric water. This ratio is less than one for marine water and more than one for meteoric water. The ratio of spring's water is less than one for all Hit-Kubasa springs.

(Sulins Diagram in Collins.1975) is show that all the springs' water is of Ca-Cl Figure 5.

This result is reflecting the marine origin for all layers bearing ground water and long period of marine deposits. During that period, the ground water of marine origin is subjected to many processes of metamorphism.

The chemical ratio rSO_4/rCl is less than marine water. This means the spring's water is very ancient and deep origin, so it suffered from different degree of reduction by bacteria in presence of organic carbon.

The water analysis shows, that rCa/rCl and rMg/rCl is more ten times than

marine water (enrichment with (Ca-Mg). This fact is explained ionic exchange condition (Sulins in Colins.1975).

The field observations show hydrocarbons with springs water, which means to present of subsurface hydrocarbons accumulation in Hit-Kubasa area.

4-Sohoeller Diagrams:

Sohoeller (1956) diagrams are representing two ideas:-

4-1-When these diagrams are parallel, that is mean similarity of these water Figure 6 and 7.

4-2-The increment of salinity in one direction is meaning the direction of ground water in this way Figure 6 and 7.

The salt increment is clear in spring's water from Kubasa city to Hit city.

This is lead to believe the migration of ground water in this way. The increment of salinity is begin from spring water of Kubasa number 8(K8), K9, K11, K12 and K13 to the direction of Hit city springs number 5(H5), H6, H7, H1, H3 and H4.

5- Structural Geology Of Area:

(Budy.1975) is divided Iraq into:-

5-1-The northern part of the African-Arabian Precambrian platform.

5-2-Steable shelf.

5-3-Unsteable shelf.

The Northern part of the African-Arabian Precambrian is limited North by Ana city depression, at Northeast is limited by Euphrates- Ramadi(city) fault and from East is limited by Abu-jer step like fault (Dittmar.1972).

According to that, the area of Hit-Kubasa is been within the Euphrates-Ramadi fault and Abu-jer fault Figure 8.

The outcrop formations in Hit-Kubasa area are shown in Figure 9:-

-Fatha formation (M.Miocene).

-Euphrates formation (L.Miocene)

Fatha formation is extend from south of Hit city parallel to springs line, while the Euphrates is clear in small depression parallel to Euphrates River from Iraqi-Syrian boundary to Hit city(Parson.1957).

The two basin bounded by many east-west direction hills. The direction of hills is curved to Northeast, then to North of Hit city to form Euphrates basin, which is consist about 90%, so it is divided into many smaller drainage basins.

Area between Hit and Kubasa(studied area) is good hydrogeological area to create many springs(Hamza.1975).

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6-Hydrogeology

The studied area divided into two basins: - (Euphrates and Thirthar Basins)

7-Geology Of Springs:

The existence of springs is controlled by two factors (Baghdadi.1973):-

7-1-Existence of aquifer (Euphrates and Dammam Aquifer).

7-2-The structural geology of area.

The field observation shows, that the distribution of springs in direction East Northeast—West southwest, so the being of Euphrates-Ramadi and Abu-jir faults Figure 8 is lead to believe that, springs are arise to earth surface under pressure of hidden hydrocarbons.

The spring's water is mixed with amount of gases and asphalt.

The being of fractures and faults in the upper part of aquifer in the studied area means, the springs are *Artesian Springs* according to classification of (Plummer.,Carlson.,and Geary.2007).

Table 1 Total dissolved salts (T.D.S), major ions and H2S concentrations for springs water

Name of spring	T.D.S	K	Na	Mg	Ca	Cl	SO4	HCO3	H2S
1-Sayyalah H1	31075	480	6876	607	1782	16100	403	212	469
2-Ataat H2	18205	540	4008	364	938	7350	681	155	428
3-Jarba H3	12230	435	2869	265	627	5950	186	85	432
4-Liak H4	11645	301	2651	210	501	5600	199	122	429
5-Almaktom H5	5640	205	866	218	426	2400	438	146	433
6-Altarrafy H6	5835	200	630	230	400	2240	421	134	425
7-Albeer H7	5365	180	619	206	375	2170	403	159	4121
8-Aljarba K8	2620	66	462	112	226	1155	202	197	2418
9-Kushata K9	3170	58	470	101	262	1373	128	183	2573
10-Kameliah K10	3660	85	501	124	321	1505	126	248	2907
11-Kubasa K11	3055	71	461	116	316	1488	91	146	2684
12-Craad K12	2975	61	403	143	276	1365	125	141	2521
13-Alnajibiah K13	3200	60	491	112	351	1478	196	183	2371

The origin of Sea water can be calculated by rNa / rCl ratio (Davis., and Dewiest1966)

rNa / rCl = less than one for sea water

HOW?

rNa / rCl is named hydrochemical ratio

rNa = ppm of Na / atomic weight of Na

= 10700 / 23 (Na -sea water)

= 465 .22 epm

So for Cl ion of sea water

= 19300 / 35

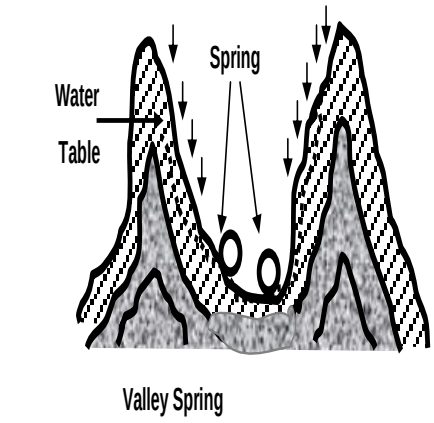
=551.43 epm

rNa / rCl = 465.22 epm / 551.43 epm

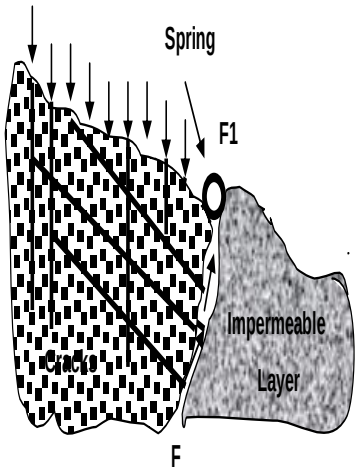
= 0.843

Table 2 total dissolved salts (TDS) and major ions for Sea, Euphrates and Dammam aquifer

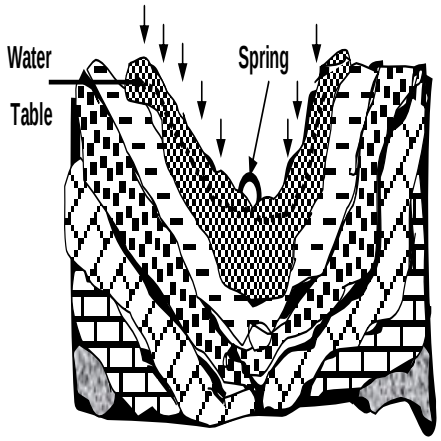
Kind of water	T.D.S	K	Na	Mg	Ca	Cl	SO_4	HCO_3
1-Sea water	35000	380	10700	1300	420	19300	270	280
2-Euphrates aquifer(average)	11500	78	2800	363	790	4766	2263	148
3-Dammam aquifer (average)	4920	30	702	223	521	976	2207	49



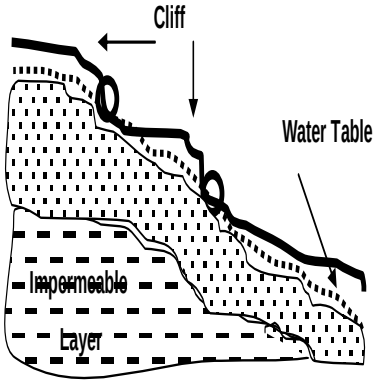
Valley Spring



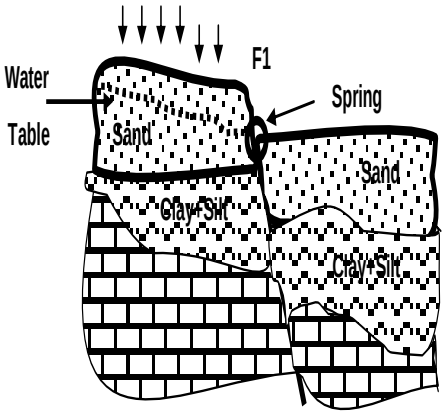
Cracks Spring



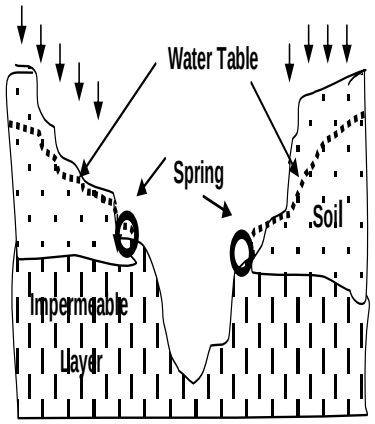
Syncline Spring



Cliff Spring



Displacement Fault



Mountain Spring

Figure 1
Kinds Of
Springs

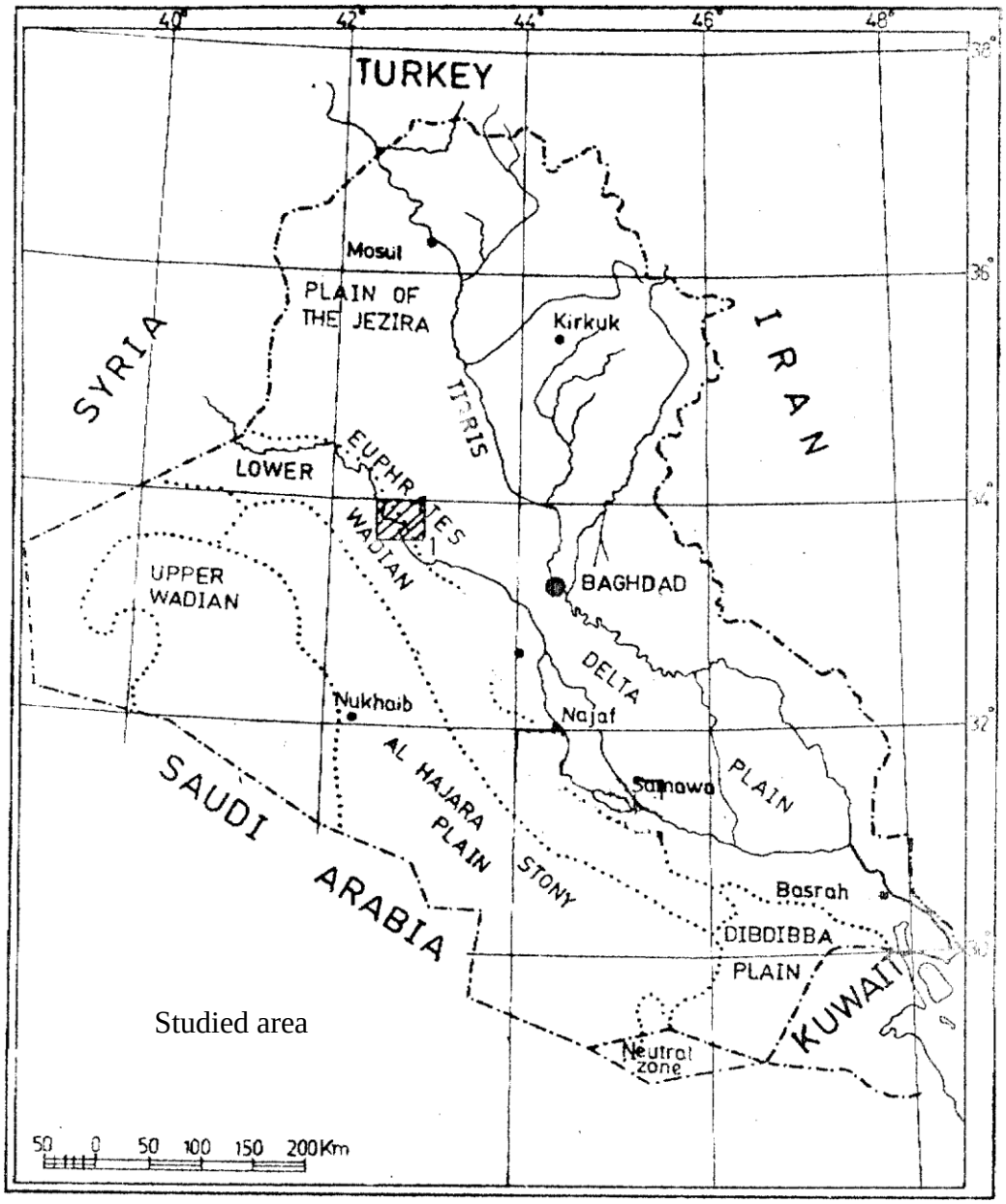


Figure (2) Map showing the studied area (after Hamza.1975)

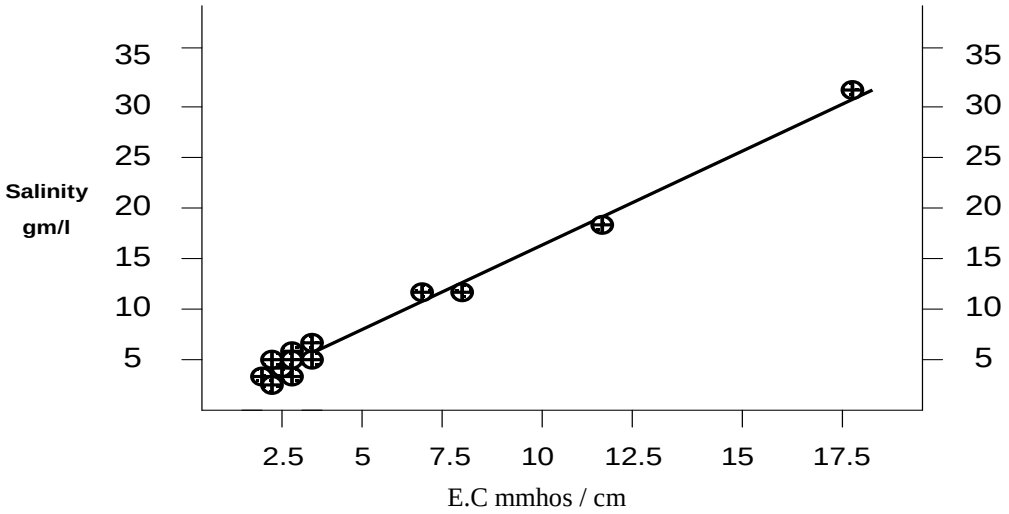


Figure 3 Relationships between Salinity and Electrical Conductivity for the Water Springs

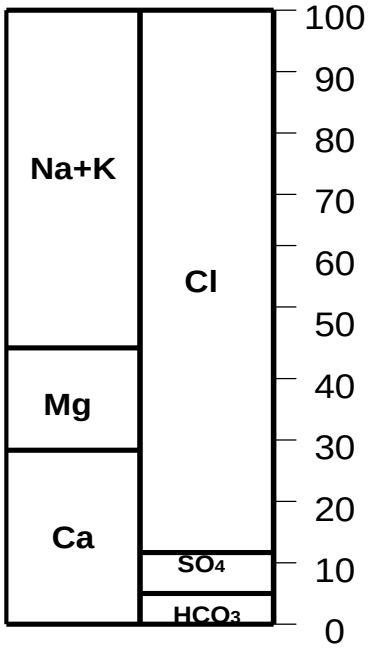


Figure 4 – Bar Diagram % total epm

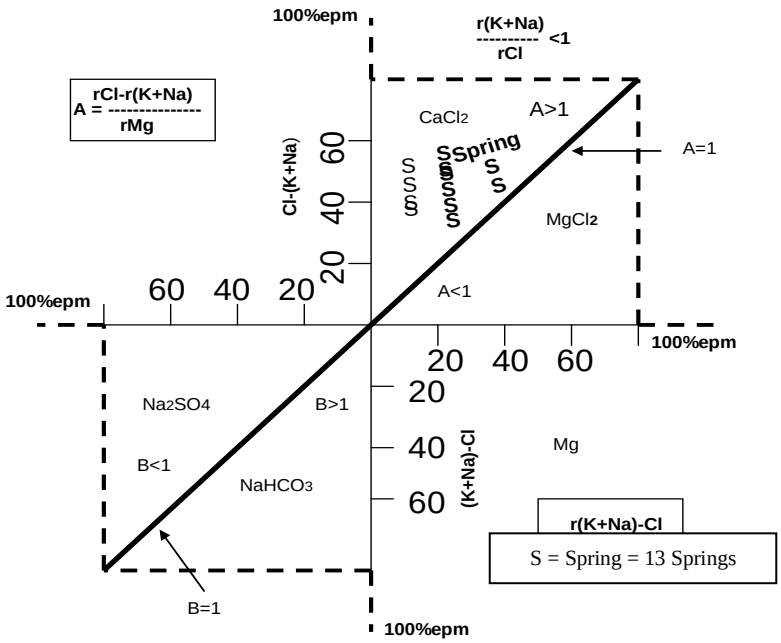


Figure 5 Sulin in Collins diagram for water springs

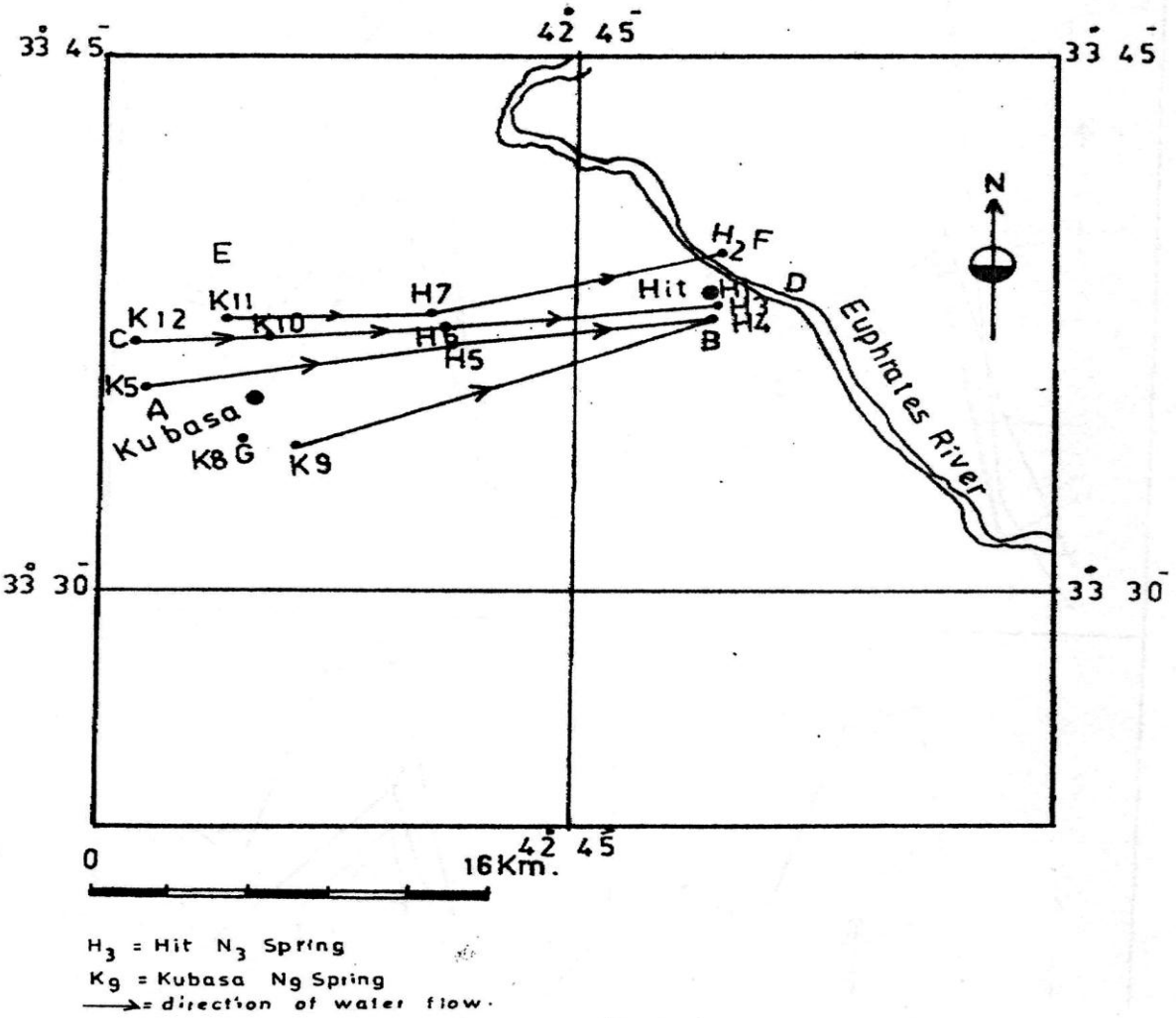


figure (6) Map showing the direction of water flow on Scholler diagram for Hit – Kubasa springs.

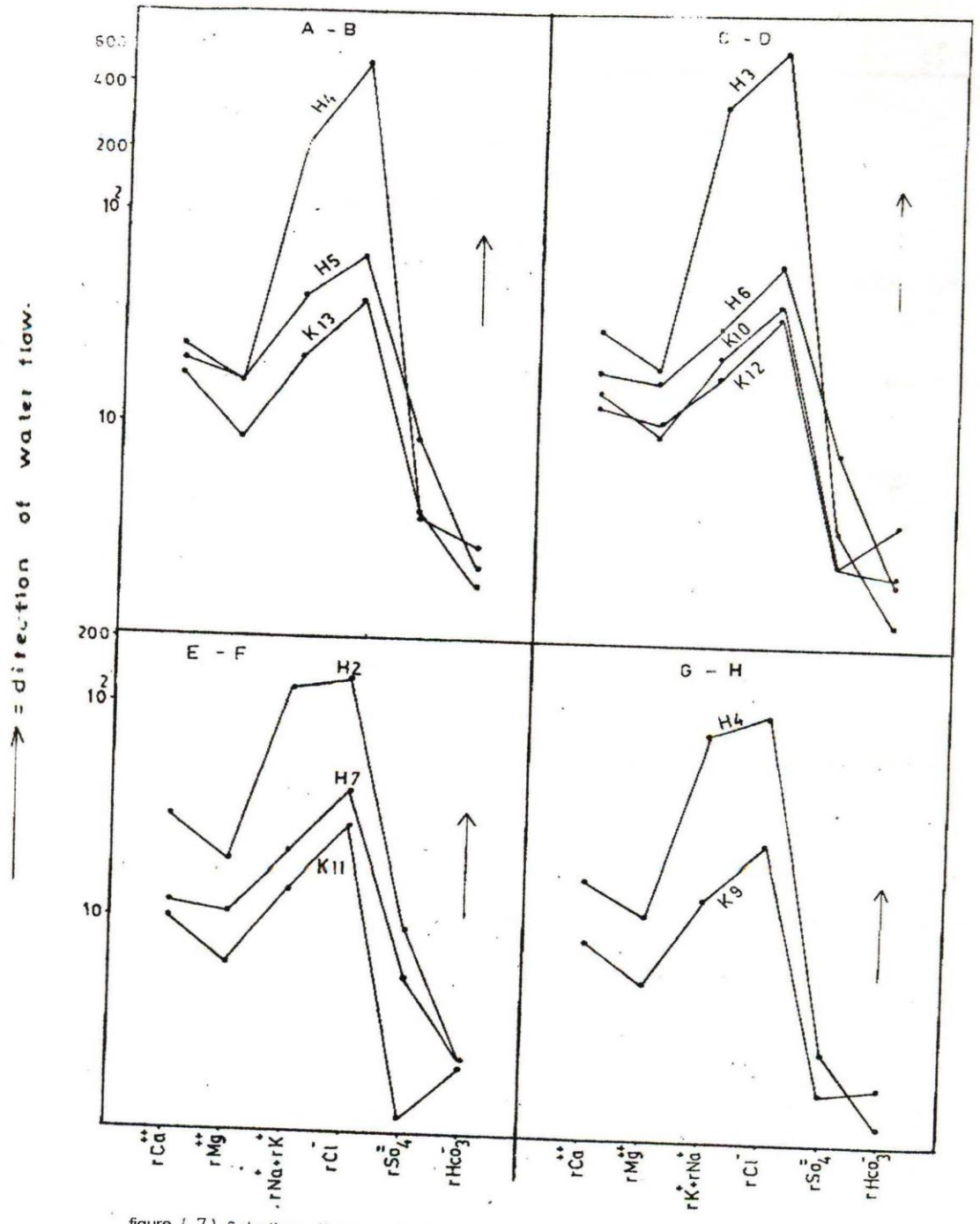
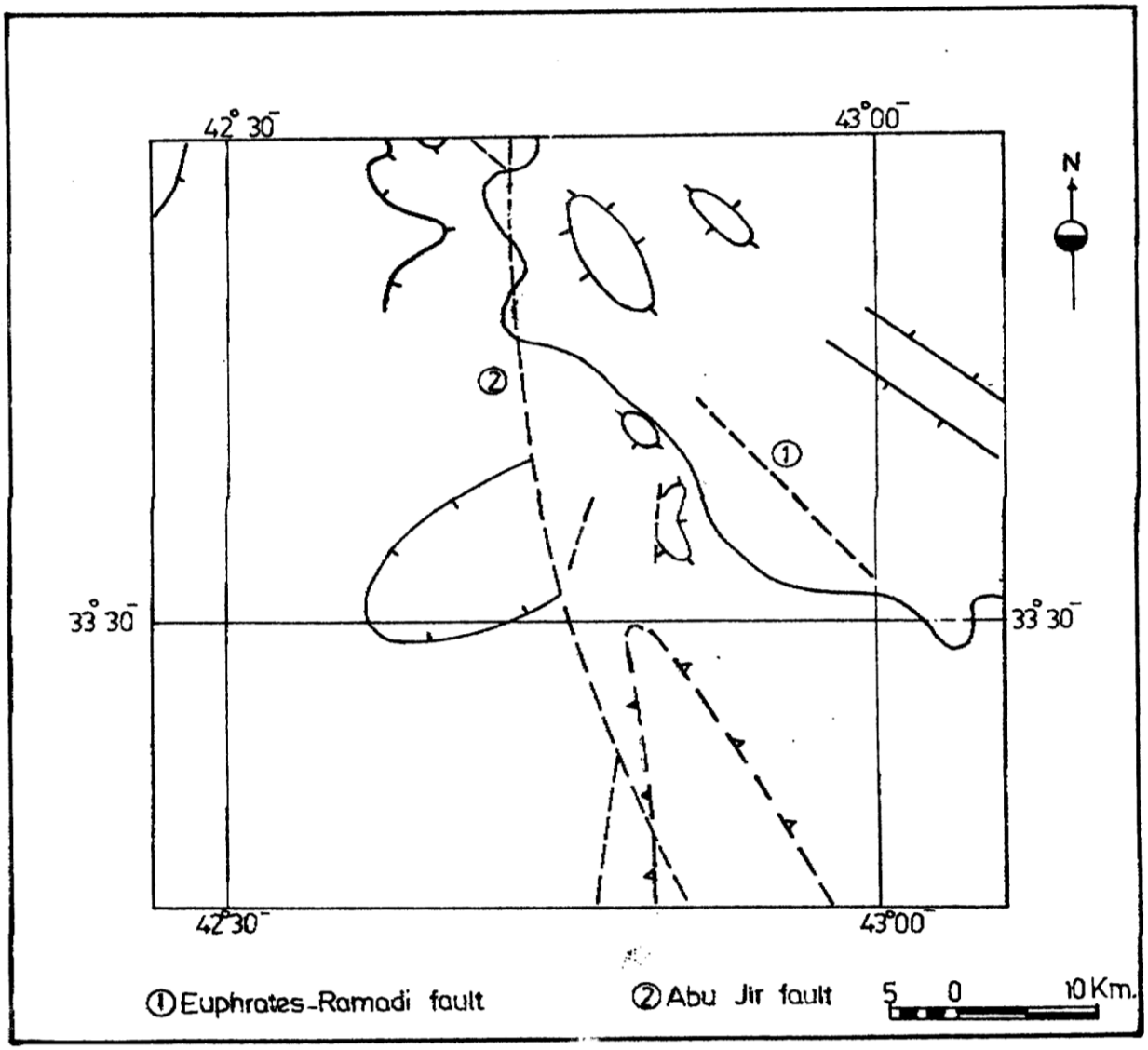


figure (7) Scholler diagram for Hit_ Kubasa springs.



figure(8)Tectonic map of the Kubaisa-Hit area and surroundings.
(Compiled by Yassi 1977- after Dittmar ,1972.)

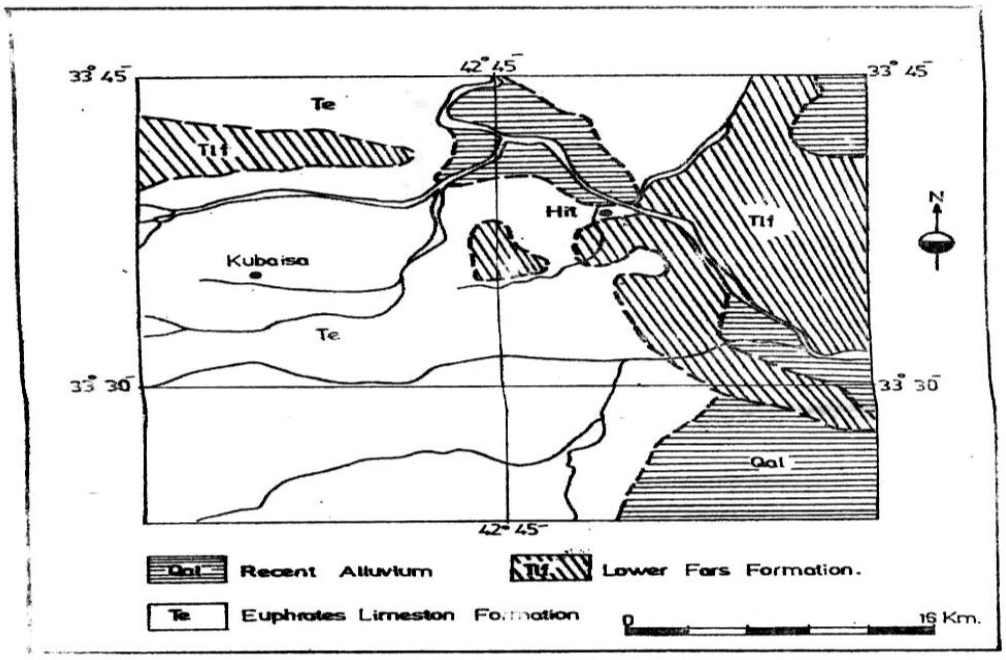


figure (9) Geological map of area.(Compiled by Yossi , 1977, after Parsone ,195
(Hit – Kubasa)

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