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THEORETICAL APPROACH TO THE ARAB HOMELAND TECTONICS AND OTHER ADJACENT COUNTRIES USING PALEOMAGNETIC INFORMATION

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ABSTRACT

During Paleozoic, the evidence for paleomagnetic criteria indicates a considerable idea that says, The Arabian and African plates with Turkey, central and north Iran were collected together as a part of one great plateau called " GONDWANA LAND ", whereas the Arabian and African plates were continued as a uni–mass within Gondwana during Mesozoic. On the other hand, central and north Iran also remain inside Gondwana at Triassic and became closer to Laurasia during this age. This means that they move far away from the Arabian shield.

Paleomagnetic results of fault region located in northern Anathoul revealed that Turkey was located inside the (Arabian – African) shield during Mesozoic, but in Jurassic, and due to magnetic pole positions, Turkey had been moved towards north and northern east relative to the Arabian plate, and at the end of Cretaceous, it moved again trending west and southern west, the matter which forced it to obduct with the Arabian shield once again.

An indication to the presence of Arabian or African plate motion during (Cretaceous – Tertiary) is recognized using paleomagnetic results obtained from the study of different regions positioned in Sudia Arabia. Moving of the African's one towards north in an anti–clockwise pattern about (20)° latitude was noticed. The second one may represent the first stages of the openness of the Red sea.

The obtainable paleomagnetic results of Aden and the adjacent areas during Miocene prove that the openness of the Red sea happened due to the rotational movement of the Arabian plate far away from the African one about (7)° in an anti–clockwise pattern, we can say that before (20) million years ago, the Arabian plate was incontact with African plate along the shore line of the Red sea and Aden Gulf.

In addition, the paleomagnetic study of Lebanon, Syria (Tartous) and north Palestine is done. It is clear that there is a great anomaly in the paleomagnetic values product from the rotation of some parts of Lebanon and north Palestine along the fault posited inside the Dead Sea. In other wards, we can say that this region (Al–Sham area) was affected by multi–faults Levantine system. All thoughts about this subject indicate that the fault presented along the Dead Sea occurred in Miocene, this matter supposts the claim that the Arabian and African plates were collected together until Miocene.

Moreover, northern and western parts of Africa were affected by the Hercynian Orogeny which occurred in western Arab homeland during Carboniferous.

INTRODUCTION

Sallomy and Miroslav, (1980) refer that Thellier (1910) had been published an opinion about continental separation for the first time, and another theory is followed by the geologist (Alfred Wegener, 1912) that deals with the plate–tectonics which assume that all recent continents were collected with each other in one great continent called " PANGAEA" during upper Paleozoic, after that, in Mesozoic and Tertiary, this Pangaea was broken and divided into seven small continents moved toward the west or the equator or both, this theory was rejected by many scientists at that time because of an apparent absence of a driving mechanism, but in spite of that, the continuous geological researches and the appearance of the important studies about sea–floor spreading and paleomagnetic of the earth had come to insure the above theory, these researches and studies clarify that the igneous and sedimentary rocks contain some remains of magnetic grains that were saved inside igneous rocks before freezing and in sedimentary one before consolidation, these grains tend to have a similar earth's magnetic field direction at that place and time. It may be possible to obtain the magnetic inclination (I) for any rock mass by studying the remains mentioned above, therefore, it is so easy to determine the location of this mass according to paleolatitude, the matter which enable to calculate the movement or the horizontal displacement that occur to the rock mass during Paleozoic. In fact, rock samples were collected from the recent continents and interpreted in order to conclude and obtain the continents distribution and it's movement directions after separation. The magnetic maps plotted from arial and land surveys give good information about the tectonic movement, and the paleomagnetic results can be considered as more important because it may be possible to investigate and detect ore bodies presence..

The main task of the present study is to reevaluate the available published paleomagnetic data and paleopole geography of the Arab homeland and the adjacent countries like Turkey and Iran, in order to make a possible review and theoretical approach to the tectonics of the above countries.

BACKGROUND THEORY

Until many centuries ago, the earth's magnetic field effectiveness study is focused on the recording of this field which is saved in rocks, moreover, most rock forming minerals were non-magnetic minerals, so, rocks were magnetized due to some iron and titanium oxides such as Magnetite and Ilmenite present as secondary minerals which caused what we call "Fossil Magnetism". If both magnetism and rocks were formed at the same time and magnetism was saved, in this case, it may be called (Natural Remanent Magnetization – NRM) that is used in determining the magnetic field intensity and direction at rocks forming time, and works as a fossiliferous compass trends to the ancient north and south magnetic poles.

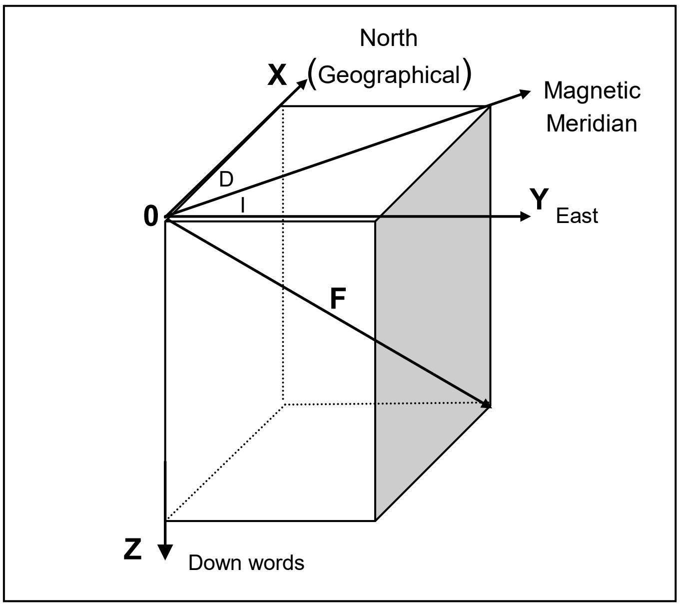
In other cases, there is an addition to the original magnetism or some of the magnetic components may be changed and form a "Secondary Magnetism". There is another type of magnetism, which is saved in rocks, and form due to the cooling operations that occurred to the magnetic rocks forming minerals passing through the Curie point (Curie temperature range between 200 and 700 C° according to mineral concerned) called (Thermo Remanent Magnetization – TRM). (Detrital Remanent Magnetization – DRM) is the last type that was caused by the arrangement of detrital magnetic grains presented in sediments.

Many principal parameters for the earth magnetic system must be collected in order to start any paleomagnetic study and compare all the obtainable results with the adjacent area, these parameters are :, (McElhing,1973) .

1. **Magnetic Declination (D):**
   It means the angle located between the magnetic north (Magnetic Meridian) and the geographical north (Fig.1), that is the direction at which the magnetic needle tends, and it is measured in the same direction of an anti-clockwise pattern about (0 – 360)° .
2. **Magnetic Dip (Inclination):**
   It represents the angle between the magnetic poles and the horizontal plane, (Fig.1).

Furthermore, (Hijab, 1984) explain that the line or the curve represents the motion of the earth paleomagnetic poles during the geological ages is called (Apparent Polar Wander Path – APWP), and the existence of the reversal magnetization at the same area may be interpreted as:

- Perioditic reversion of the earth's magnetic field that caused a considerable magnetism to the rocks at the opposite direction of the magnetic field in the investigated area.
- Rotational movement occurred in the studied region and reached about (180)° relative to the direction of recent magnetic axis.



(Fig.1) The main components of the paleomagnetic poles directions

METHODOLOGY

1. Sampling:

One of the most simplest techniques used in sampling in order to recognize and determine the paleomagnetism is the selection of groups of different sites for any structural area with limited geological age, then some of the oriented samples collected from the above sites were taken and separated into groups of specimens to make it easy to study the fossiliferous magnetic variation with the same sample (measuring the remanent magnetism is carried out with highly sensitive galvanometer). A statistical method is used to calculate the average direction of (NRM) in each site in order to detect the general direction of the rock unit magnetism.

2. Magnetic and thermal cleaning methods:

It is important to remove unstable magnetic components (secondary) resulting from the influence of the lightning or chemical origin (Chemical Remnant Magnetization - CRM which formed due to the growth or recrystallization of the fine magnetic grains and enclosed by another minerals at a temperature less than Curie point) or resulting from secondary heating or even shearing stress. These components certainly affect the value and direction of stable (NRM).

Magnetic cleaning (stability tests) is carried out using a magnetic filed with a low intensity (measured in Orested unit) and is subjected to the selected samples; thus, the direction and intensity of the formed magnetic field inside these samples due to Demagnetization were determined.

Here, the condensation range that occurred to the direction of the secondary components can be observed. Then, we have to increase the subjected magnetic field intensity on the sample and measure both direction and intensity of the forming magnetization in the same sample. This operation must be done for several times by the employment of alternative magnetic fields (rice it gradually) in order to obtain a high condensation of unstable secondary components direction, after that, it will be so easy to remove these components completely.

Similar steps can be done for the thermal cleaning operation, but the only difference between them is to use a high temperature(C°) instead of the alternative magnetic field.

By finishing these two tests, the (NRM) direction can be recognized for each sample, also, we can obtain the (NRM) direction for every site by calculating the mean of the magnetic direction which is presented in these samples, (Irving, 1964).

3. Presentation of the magnetic direction:

After measuring the direction and magnetic intensity of the above samples, each direction will be drawn over a plane surface called (Streographic Projection) or (Schmitd net, equal area net, Wulff net). Every direction will be drawn as a one unit length limited by polar coordinates (I & D), in many cases, polar projection might be used, the direction can be presented by a point projected on the surface above, and the plane which passed through this point and polar projection from an angle with the north of the plane surface called (Declination-D), The inclination angle (I) is the distance between this point and the original point, This is in case of horizontal beds, if the beds are inclined, here we must return it to it's horizontal situation by rotating the direction around the strike of these beds equally to the true dip angle amount and then plot the calculating directions. Another statistical method is used by (Irving, 1964) called (Circle of Confidence) symbolized as ($\propto_{95}$), this means that (95%) of the total reading is located under this circle, and if the confidence circle is so small, the magnetism that exists in the rock will have a high stability (decreasing of secondary components).

PREVIOUS STUDIES

(Table–1) below shows the important results obtained from the previous researches dealing with the paleomagnetic measurements of most of the Arab homeland and other adjacent countries like Turkey and Iran. They are useful in plate – tectonic determination for these countries.

RESULTS AND DISCUSSIONS

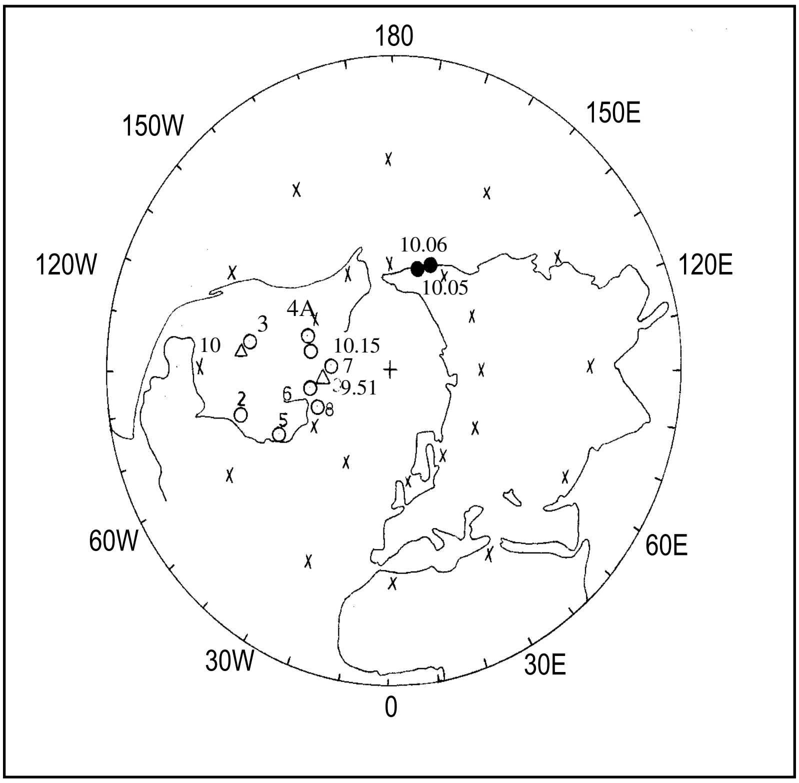
1. Paleomagnetic data

A. Turkey

Nine oriented sedimentary and igneous rock samples had been collected from the northern and eastern parts of Turkey. After the removal of the secondary components and (NRM) measurements, (Vander Voo, 1968) offered to calculate the magnetic direction that is saved in these rocks, so, magnetic poles positions can be easily determined, (Fig.2).

(Table – 1) The paleomagnetic results and poles positions of the most Arab homeland and other adjacent countries

Researcher	Year	Country	Region or Formation	Geo. age	No. of Sites	No. of Sample	D	I	Magnetic Poles Positions	α_{95}
Vander Voo	1968	Turkey	Tunceli	Eocene	1	2	125.°5	48°	65°N ,66°W	3
			Gumushane	Up.Cret-Eoc.	2	3	346°	40°	69°.5N , 98°.5W	9.1
			Gumushane	Cretaceous	1	2	153°.5	36°.5	60°.5N , 81°.5W	7.8
			Niskar	Cretaceous	1	2	140°	36°.5	51°N , 64°W	5.8
Wensink & Var kamp	1980	N.Iran	Alborz	Cretaceous	20	35	33°.3	47°.5	61°N , 147°.5E	7.2
Wensink	1983	Central Iran	Red bed	Devonian	13	18	24°.2	1°.3	51°.3N , 163°.7W	10.1
Hijab	1983	Iraq	Ubaid Fn.	L.Jurassic	-	-	159°.3	15°.8	210°.1N , 61°.6E	9.5
				L.Jurassic	-	-	21°.3	13°.6	187°N , 54°.9E	12.4
Vander Voo	1967	Lebanon	Middle and South Lebanon	Kimmeridgian	6	20	92°.5	10°.5	1°N , 120°E	3
				Aptian	5	15	313°.5	9°.5	38°N , 78°W	5.5
Gregor	1974			U.Cretaceous	4	10	95°	21°	2°N , 114°E	10.6
				L.Cretaceous	1	2	122°	2°	25°N , 105°E	9
				U.Pliocene	6	16	2°	46°	88°N , 169°E	7.7
Vander Voo	1967	Syria	Tartous	Pliocene	2	7	170°	7°	73°S , 71°E	10
Helsley & Nur	1970	Palestine	AL-Naqib	L.Cretaceous	3	22	130°.5	5°	59°.5N , 105°.8E	8.7
			Carmel	U.Cretaceous	1	15	4°	53°	41°.6N , 95°.8E	12.1
Irving & Tarling	1961	Yemen	Aden	Tertiary	12	164	7°	24°	12°.4N , 45°.1E	5.3
Davies	1980	Egypt	Abu -Tereifiya	Tertiary	12	150	187°.9	20°.8	69°.4N , 188°.3E	5.8
			Mandisha	Cretaceous	2	30	191°	5°.2	58°.2N , 186°.7E	9.9
			Abu - Shihat	Jurassic	7	70	142°	-0.3	44°.9N , 273°E	6.7
Morel	1981	Morocco	Sedi - Abdulah	Permian	7	21	139°	11°	29°S , 60°E	6



(Fig.2) Paleomagnetic poles positions of Turkian plate during Mesozoic

From the comparison between the above results and those obtained from the Arabian, African and Eurasian plates, we can conclude that the Arabian, African and Turkian one worked together as one drifting unit till Mesozoic.

B. Iran

Wensink & Var Kamp, (1980) compare the results which were determined from the oriented samples that had been collected from Alborz mountains (locates at north Iran) with those results of the Cretaceous rocks lying at southern Soviet's Union previously and the obtained results of the Arabian and African plates. This comparison shows that the northern part of Iran was posited in it's present location relative to Laurasia. This means that northern Iran is a part of Gondwana till Mesozoic because the paleomagnetic information that is taken from the intrusion basaltic rocks at the upper boundaries of Devonian and Carboniferous reveals that northern Iran was located on the edges of Gondwana and the obtainable results from the volcanic rocks that were collected from Alborz mountains at Permian and the beginning of Jurassic indicated that Iran was a part of Gondwana until Permian, after that, Iran slipped from Gondwana in Triassic and adhered to the Asian continent after a short period.

This is a distinct difference between the results obtained from both central and northern Iran. Central Iran was surrounded by various faults due to the compressional forces which caused a rotational motion at Mesozoic and early Tertiary. The paleomagnetic results obtained from the Mesozoic sediments indicated the occurrence of simple translational and rotational movements that affected the rock masses presented nearby the fault region. This means that the geologic and geographic poles were deformed and destroyed, the reason which makes it impossible to use the paleomagnetic results of this region. But, all these results indicated that central, northern Iran and Afghanistan were formed as a uni-mass presented within Gondwana in Paleozoic till Jurassic. Devonian red rocks beds which were posited in central Iran revealed that Iran was located nearby the equator which passed through northern Arabian Gulf at that time, (Wensink, 1983).

C. Iraq

Through the comparison between the results which were determined from the Arabian and African shields with those collected by (Hijab, 1983), it's clear that Iraq was a part of Gondwana till the end of Paleozoic and the beginning of Mesozoic. Iraq slipped from it and adhered to Asia in Triassic.

D. Syria and Lebanon

From the comparison between the results which are shown in (Table-1) with those related to the African and Asian poles, a big contradiction can be observed. This is because of the magnetic reversal that occurred during Jurassic and Pliocene, which can be interpreted as a resultant of locally small tectonic motions. In order to explain these information, we have to notices the following:

1) The reversal of the earth magnetic field.
2) The average of the secular variations of the magnetic field.
3) The local earth motions.
4) The greatest tectonic movements that occurred in Africa and Lebanon at the same time.
5) Continental drifting.
6) Apparent polar wander path (APWP).

In order to return the deviation of the pole position by corner (140)° which happened during Kimmeridgian and Aptian, we must take the point (1) above into consideration that the poles were reversed during Kimmeridgian, in other wards, we must consider the coordinate (1°N, 120°E) as a south pole. This assumption doesn't correspond with the known information of the upper and lower Jurassic, (Irving, 1964).

Moreover, the evanescent time from Kimmeridgian till Aptian may equal (15) million years, and during this, it is impossible for the magnetic poles to be reversed; therefore, the above remaining points were taken into consideration to deduct the following:

1) Except for any displacement that happened for Lebanon relative to Africa, the contrast is equal (28)° between the African pole position (upper Cretaceous) and the Lebanon one (Aptian).
2) The contrast between upper Cretaceous African pole and Aptian Lebanon pole is equal to (19)°, whereas the Arabian mass was moved towards the eastern north relative to the Arabian shield, (Irving & Tarling, 1961).

The difference between the magnetic poles of Africa and Lebanon at (upper Jurassic- Pliocene) resulting from the rotational movement at an anti-clockwise pattern is amounting to (70)° relative to the Arabian and African plates, this has occurred from the difference of motion between the two plates, European and African. They moved far away from each other due to the openness of the Atlantic ocean (the opening of the Mediterranean sea), whereas the tracts which delimit the Mediterranean sea from the east (Lebanon, Palestine and Syria strands) were a part of the

(Nubian-African) shield before the opening of Tethys. This means that all the regions were affected by the same tectonic movement specially these strands. Facies similarity between the African and Lebanon over along time had made the above idea more certainly.

Furthermore, Lebanon was divided by the multi-faults Levantine system, or by it's alternative movement between these two masses along the Dead Sea fault.

E. Palestine

Helsley & Nur (1970) compared the paleomagnetic results related to Palestine with magnetic poles positions of the lower Cretaceous of Africa. This comparison revealed that the poles posited at southern Palestine (Al-Naqib desert) were located on the edge of the circle of confidence of the African pole. In other wards, the African and Palestine poles were corresponded till that period. That means, southern poles were not affected by the rotational movement that occurred in Lebanon. While the other region which is called (Carmel) was also out of the Lebanon activity and the rotation which happened here was caused by the continuous faulting of the Dead Sea inside the Lebanon's area till the end of Oligocene. The little difference between the African and Palestinian poles positions is amounting to (10-15)° at an anti-clockwise pattern, this may interpret as follows:

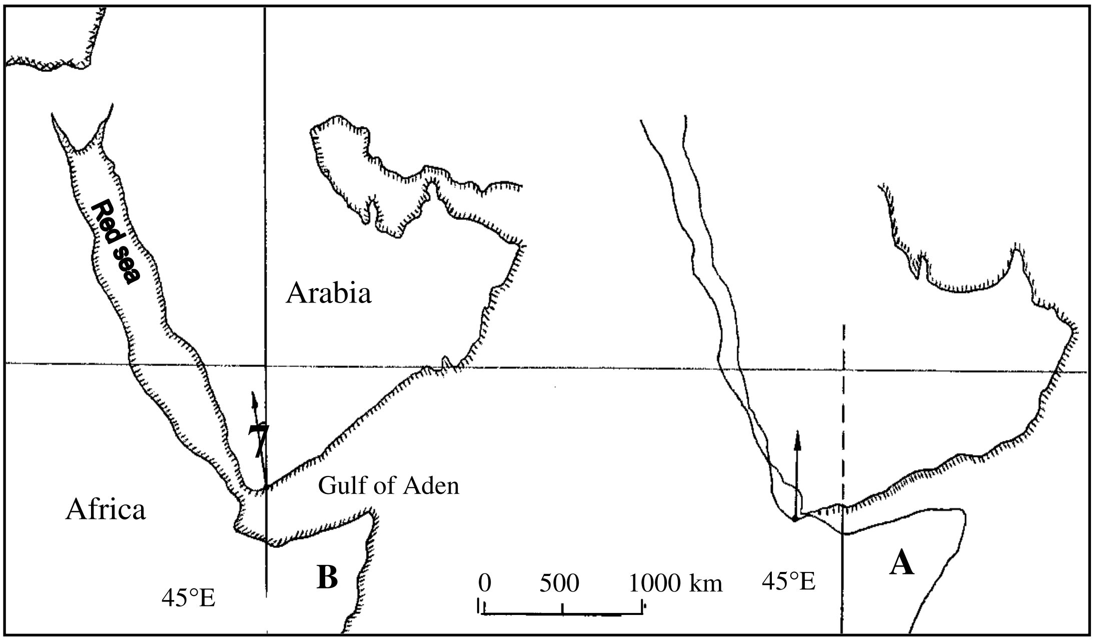
1) The first six degrees were associated with the opening of the Red Sea.
2) The other nine degrees (at the same direction) were caused by the deformation that entered to the south of Palestine and the north of Sinai. Faults existence which strikes (E-W) perpendicular to the Dead Sea faulting zone is observed inside this region.

F. Yemen and the openness of the Red sea

The results obtained from this region (include a good information about secular variations and poles reversion during the end of Cenozoic) were strongly related with the original of the Red sea; whereas the paleomagnetic directions have equally deviated from the actual north and the deviation may be resulting from the rotational movement of the Arabian plate relative to Africa at an anti-clockwise pattern. Creditably, this indicates the openness of the Red sea. From the observation of the ancient magnetic pole for sets of rocks located in Aden, we can notice three distinct differences as follows: (Irving & Tarling, 1961)

1) The presence of the magnetic scattering in different directions around the mean directions of these sets.
2) The presence of the variations in mean directions of these sets.
3) The presence of polar reversion resulting from the reversal of the magnetic field at the end of Cenozoic.

The scattering of the magnetic directions that is considered as a high stability represents the forming stages of the Red sea. It known that the main fault which associated the opening of the Red sea begun at the middle of Tertiary, on the other hand, during Oligocene, sea-floor subsidence took place and continued deeply at Miocene. This is the first stages of the openness of the Red sea. The rifting of the Red sea and it's extension into the Jordan's valley happened due to the increase of the motions at the south which caused the opening of the sea about (30) Km, and the decrease in Syria to becomes equal to zero because of the rotational movement of the Arabian Peninsula around a certain point inside Sinai at an anti-clockwise pattern. The paleomagnetic results which saved in the rocks were presented at the two sides of the Red sea, specially the collected data from the volcanic formations of Aden that clarify the reversal magnetism, (Fig.3)



(Fig.3) The opening of the Red sea

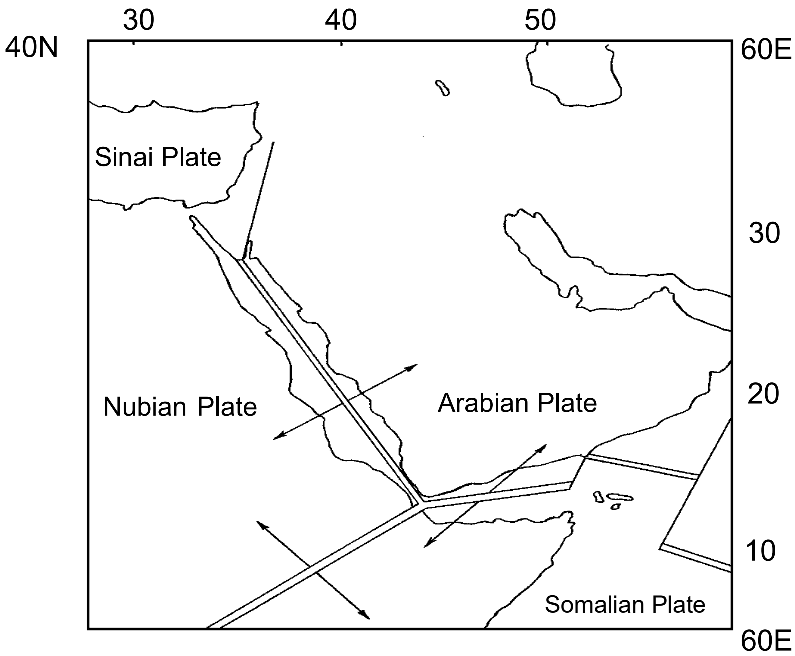
Moreover, the paleomagnetic results of this region indicate that the Arabian and African plates moved towards the north during Cretaceous till Tertiary, (Table-2).

(Table-2) The paleomagnetic poles positions of the Arabian and African plates

Plate	Period	Pole Positions	α_{95}
Arabian	Upper Cretaceous	82°S, 35°E	6
	Upper Cretaceous	69°S, 84°E	18
	Cretaceous	51°S, 95°E	14
	Jurassic	39°S, 93°E	14
	Mesozoic	48°S, 93°E	12
	Permian	18°S, 102°E	12
	Carbo-Ordovician	37°N, 323°E	12
African	Upper Tertiary	87°S, 332°E	2
	Lower Tertiary	85°S, 6°E	2
	Cretaceous	61° S, 82° E	2
	Mesozoic	65°S, 82°E	4
	Lower Permian	27°S, 89°E	4
	Upper Carboniferous	46°S, 40°E	4
	Permo- Carboniferous	40°S, 64°E	4
	Lower Carboniferous	26°S, 26°E	4
	Cambrian and Ordovician	26°N, 345°E	25

The three tectonic plates that met together at the southern Red sea (Arabian, African-Nubian and Somalian) and the floor-spreading of the rift valley represent the first stages of the openness of the Red sea, (Fig.4).

A comparison was made between the paleomagnetic results and the poles positions that were obtained by (Gouda et.al. 1979) with the African apparent polar wander path. It reveals that they were corresponded with the remaining African poles at Mesozoic. This indicates that there is no evidence of any motion occurrence inside the area until the present time.



(Fig. 4) How the Arabian, African - Nubian and Somalian plates met and join together southern the Red sea G. Egypt

H. Morocco

Mortin *et.al.* (1978) have compared their results with the African's (APWP). The comparison shows that they were corresponded. On the other hand, Morocco was affected by the "Hercynian Orogeny" which occurred at Carboniferous. Eastern and northern parts of Africa were influenced by the collision between Laurasia and Gondwana due to this Orogeny.

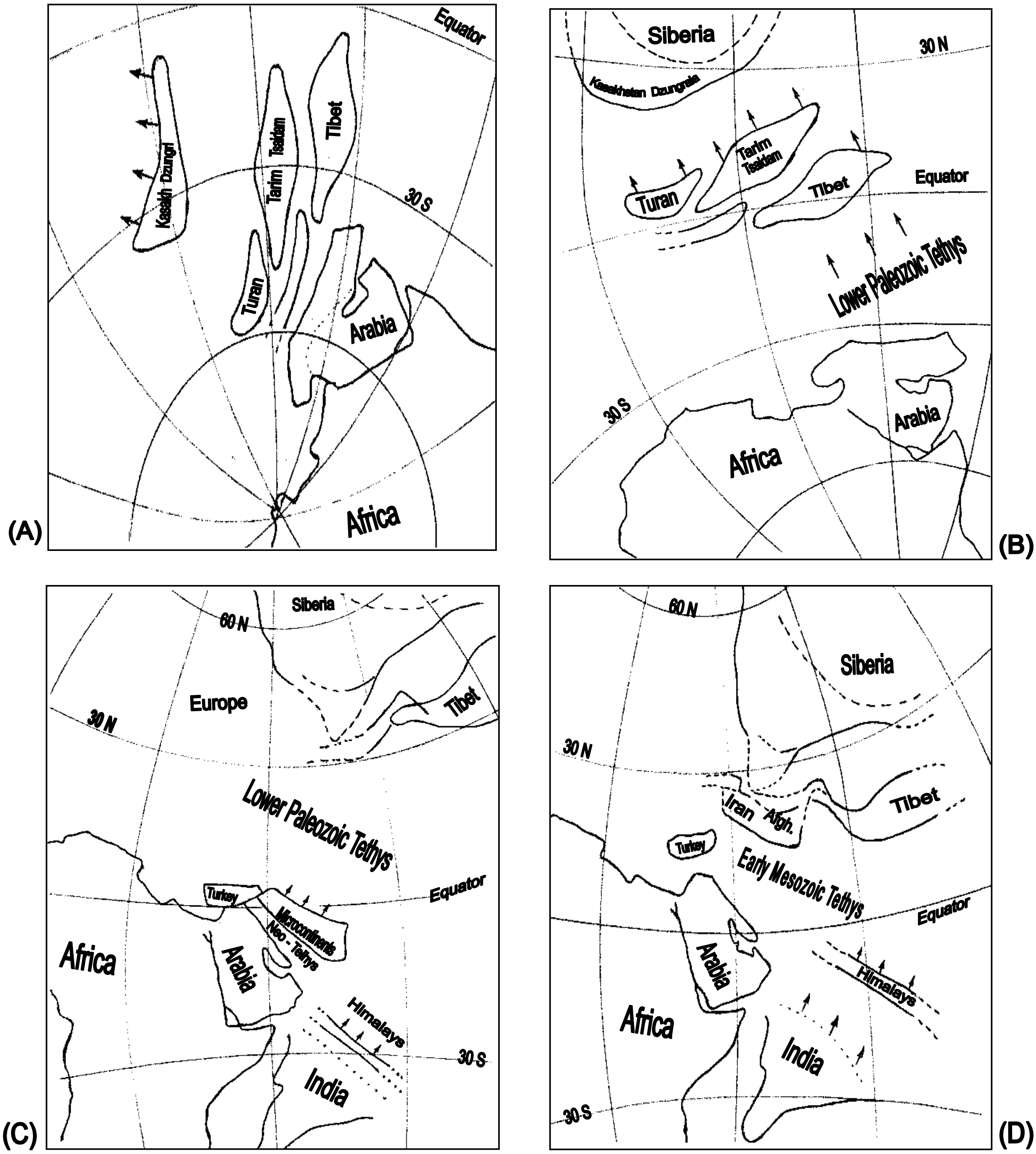
Through the comparison between the paleomagnetic results of the paleoages till Cretaceous and those obtained from the sedimentary rocks, we can notice that there was no existence of any rotational movement of the Moroccian plate or deserts since Permian. In other wards, Morocco remained in it's place since Permian until the present day, and there is no occurrence of any next rotational tectonic movement relative to the African shield, (Morel et.al., 1981).

2. Plate- tectonics of the studied areas

All of the performed researches about the paleomagnetic information which belong to the Middle East regions (especially the Arab homeland) focused on some geologic ages in order to prove the plate-tectonic theory. These results clarify that Turkey, Iran and central Afghanistan were a part of the Arabian shield during Paleozoic until the beginning of Mesozoic. (Precambrian-Cambrian) period was presented by the existence of a major continental mass called (Pangaea) associated with miner continental masses like Chinese shield, Siberia and some of the small shields, (Irving, 1979).

Laurasia and Baltica were formed at Ordovician, they separated from Pangaea and left Gondwana behind, although, Siberia was moved towards south. So, the continents were opened and the formation of seas happened. Turkey, Iran and the remaining parts of the Arab homeland continued as a uni-mass inside Gondwana till the end of Silurian, and the obduction that took place between (Laurentia, Baltica) with Gondwana caused the "Caledonian Orogeny" which formed the caledonite mountains series at eastern strands of north and southern American and the western one of Africa. This means that the western parts of Africa especially Morocco was directly affected by this Orogeny. Moreover, the uplifting of the depositional basin in Iraq also occurred by the same Orogeny and here the erosional activities made it's effect during Silurian and Devonian.

During the middle Devonian, Laurentia and Baltica met together with Siberia, by which they formed (Laurasia). Here, the paleotethys opened along the connected line between Siberia and Laurasia, (Hijab, 1984), (Fig.5).



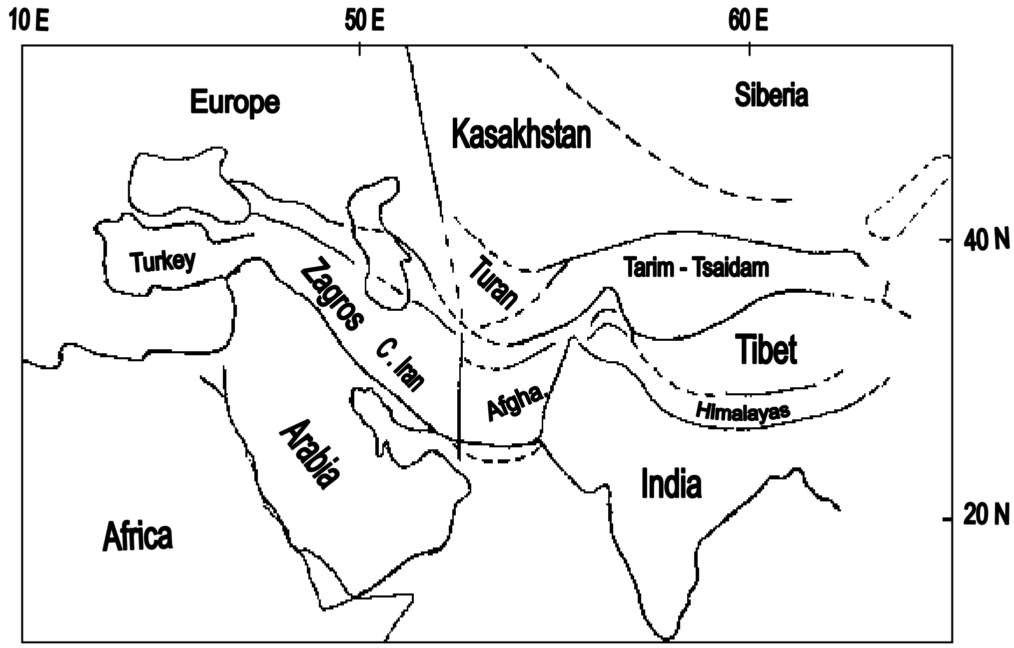
(Fig. 5) Plate – tectonics of the studied areas during:
Ordovician period (A) , Devonian period (B) Triassic period (C) and Cretaceous period (D)

And, due to the openness of this paleotethys, alternative movement between Gondwana and Laurasia took place that caused the "Acadian Orogeny". Northern and southern America was directly influenced by this Orogeny, while the Arabian and African shields were not.

During Carboniferous, the paleotethys was closed due to the collision between both Gondwana and Laurasia once again, that's caused the "Hercynian Orogeny", in which it formed the Hercynian belt and affected the northern and eastern parts of Africa.

Africa moved and obducted with Europe during Permian and Triassic (continuous of Tethys closeness). For this and during Paleozoic, the whole area in addition to Turkey, (north, central) Iran and central Afghanistan represent a part of the (African-European) plateau, and it's rock units were similar during this period. The paleotethys closeness continued towards the north and the openness of the neo-tethys started between Iran and Turkey (north and northern parts of Iraq) during Triassic until Jurassic, whereas, Indian, Iranian and Turkian plates began to leave Gondwana, (Irving, 1979).

Neo-tethys disappeared under Turkian and Iranian plates during upper Cretaceous, and at the beginning of Tertiary, the closeness of this tethys was completely finished, which caused the "Alpine Orogeny". This is the reason of the Arabian and (Turkian-Iranian) collision which took place at north and eastern parts of Iraq that formed the "Zagros mountains" in Iran and "Anathoul, Torous" one at Turkey. Italy and Spain also left Gondwana towards Europe due to the above Orogeny, that caused the openness of the "Mediterranean sea", whereas the Red sea was opened during early Miocene and resulted from the rotational movement of the Arabian plate in an anti-clockwise pattern relative to the African one, (Irving & Tarling, 1961), (Fig.6).



(Fig.6) Plate – tectonics of the studied areas during Tertiary

CONCLUSIONS AND RECOMMENDATIONS

1. During Paleozoic, the evidence for the paleomagnetic criteria indicates that the Arabian, African, Turkey and central Iran were collected together as part lands of the great continental plateau called "Gondwana Land".
2. Turkey, Iran and central Afghanistan represented a part of the Arabian plate during Paleozoic till the beginning of Mesozoic, whereas the (Precambrian-Cambrian) period was presented by the existence of a uni-major continental mass called "Pangaea" associated with miner continents. But, Iran was closer to the Laurasia plate at Jurassic and moved far away from the Arabian shield.
3. Paleomagnetic results of the fault region located in northern Anathoul revealed that Turkey was positioned inside the (Arabian-African) shield during Mesozoic. But in Jurassic, and due to the paleomagnetic poles positions, Turkey had moved towards north and northern east relative to the Arabian plate, and at the end of Cretaceous, it moved again at western and southern west towards the Arabian one.
4. The obtainable paleomagnetic results of Aden and the adjacent areas during Miocene prove that the openness of the Red sea happened due to the rotational movement of the Arabian plate far away from the African one amounting to (7)° in an anti-clockwise pattern.
5. The paleomagnetic results of Lebanon, Syria (Tartous) and north Palestine indicate that there are great anomalies in these results produced from the rotation of some parts of Lebanon and north Palestine as a resultant from the complicated movement along the fault presented inside the Dead sea.
6. During Carboniferous, northern and western parts of Africa were influenced by the Hercynian Orogeny that occurred in western Arab homeland. Also, the Arabian and African plates were continued together as a uni-mass within Gondwana during Mesozoic and there is no evidence for any motion that might happened in Egypt.
7. Detailed paleomagnetic study should be carried out with the assistance of the remote sensing techniques in order to understand the plate tectonics of the studied areas accurately.

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