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Palaeomagnetism and Opaque Petrography of the Cretaceous Ophiolitic Sheeted Volcanics at Kapedhes, Cyprus

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ABSTRACT. A palaeomagnetic study of 231 oriented drill cores collected from 29 sites from the Kapedhes sheeted volcanics in Cyprus (33.3°E, 35.0°N), has shown a high intensity of magnetization (mean value = 5.5 $\mathrm{mAm^{-1}}$), and low MDF (medium destructive field) during the alternating field demagnetization (12 to 15 mT). The petrographic studies of thin and polished sections have indicated fine grained titanomagnetite crystals in accordance with the rock-magnetic results. All samples have positive stable direction of magnetization indicating an age during the Cretaceous long positive polarity chron between 83 to 118 Ma. The main stable direction of magnetization is: $D = 301.2°$, $I = 22.2°$, $n = 29$, $K = 32.3$, $\alpha_{95} = 4.8°$ yielding a pole position at 294.1°E, 32.0°N. The individual direction of each site indicates a doming of the volcanic sheet by an angle of 20 to 0°; the axis of doming is in a NE-SW direction. Rotating of Cyprus clockwise by an angle of 33.3° around a pole at 36°E, 38°N makes the Cretaceous pole of Cyprus in considence with the African poles for ages between 110 and 120 Ma.

KEY WORD: Palaeomagnetism and Petrography of Cyprus Ophiolite.

Introduction

Intensive rock-magnetic studies were carried out on samples from the drill cores from hole number CY 2 and CY 2a through Troodos Ophiolites. The studies indicate a dramatic variation with depth of the magnetic susceptibility, intensity of natural remanent magnetization, and medium destructive field. These variations occur over certain transitional zone (Hall *et al.* 1987, Schoenharting 1987). The microscopic study of opaque minerals indicates low temperature oxidation and recrystallization of titanomagnetite grains at the same transitional zone. Replacement of titanomagnetite by sulphide minerals, specially pyrite, was observed (Johnson and Pariso 1987, Auerbach and Bleil 1987).

The palaeomagnetic studies on samples from the Troodos Pillow lava indicate a normal polarity of these lavas and a western declination with rather shallow inclination. This indicates the migration of Cyprus from low latitudes (18-21°N) to the present at 35°N (Moores and Vine 1971, Shelton and Gas 1979, Auerbach and Bleil 1987). Shelton and Gass (1979) tried to construct several models of rotation of the Cyprus microplate depending on the palaeomagnetic and tectonic parameters. Some of these models contradict the tectonic setting of the Troodos massive with respect to the Eastern Mediterranean (Robertson and Woodcook 1979). The present work deals with the palaeomagnetism of the sheeted volcanics of Cyprus in order to get some new data for the construction of a reliable model of the rotation of Cyprus microplate with respect to the African plate, and for better understanding of the general tectonics in East Mediterranean region.

Palaeomagnetic Measurements

A number of 231 oriented samples were drilled at twenty-nine sites from the ophiolitic sheeted volcanic at Kapedhes, Cyprus (Fig 1a). The number of samples per site is varying from five to twelve (Table 1). The cores are 2.5 cm in diameter and most of them are 9 cm long penetrating the unweathered portions of the rock. The local value for magnetic declination in the sampling area is estimated to be 3.5°E (chart for magnetic declination: Wienert 1970, Merrill and McElhinny 1983). Frequent checks on north direction were made against the maps by sighting on distant object. No appreciable magnetic anomalies were noted in the area. The samples were cut into specimens of 2.5 cm long and a coordinate system was set up on each specimen. The natural remanent magnetization (NRM) was measured using a fluxgate spinner magnetometer (Table 1, Fig. 2a). Between 2-3 pilot specimens from each site were subjected to alternating field (a.f.) demagnetization stepwise up to 100 millitesla (mT) peak values. No thermal demagnetization is needed since the a.f. demagnetization is sufficient to remove the viscous magnetization vectors as part of the natural remanence. The investigated samples are of rather low coercivity since the intensity of NRM is reduced to half its value at a.f. peak values less than 15 mT. No systematic magnetic overprints are present. Fig. 3a and 3b show vector diagrams of the magnetization of a sample from each site (Fig. 2b). The natural magnetization of all samples remains of normal polarity over the entire range of a.f. treatments and the components are decreasing linearly towards 0 (Fig. 3a and 3b). All other samples were subjected to a.f. demagnetization at appropriate peak values according to the vector diagrams. Characteristic remanent magnetization (CARM) was then measured. Table 1 shows the parameters of NRM and CARM together with their Fisherian statistical parameters, while Fig. 2a and 2b represent the mean direction of NRM and CARM respectively together with their α_{95} oval (α_{95} is the semiangle of the cone of 95 present confidence around the main direction). These mean directions of CARM are corrected according to tilt parameters (Fig. 1c, Table 1), and then the virtual geomagnetic poles (VGP) were calculated (Table 1). The mean direction of all means before tilt correction is: D = 306.3°, I = 56.8°, n = 29, K = 22.8, α_{95} = 5.7° yielding a pole position at 322.9°E, 47.2°N. The mean site directions of CARM is corrected for tilt (Fig. 4a) and the mean direction of all corrected means is D = 301.2°, I

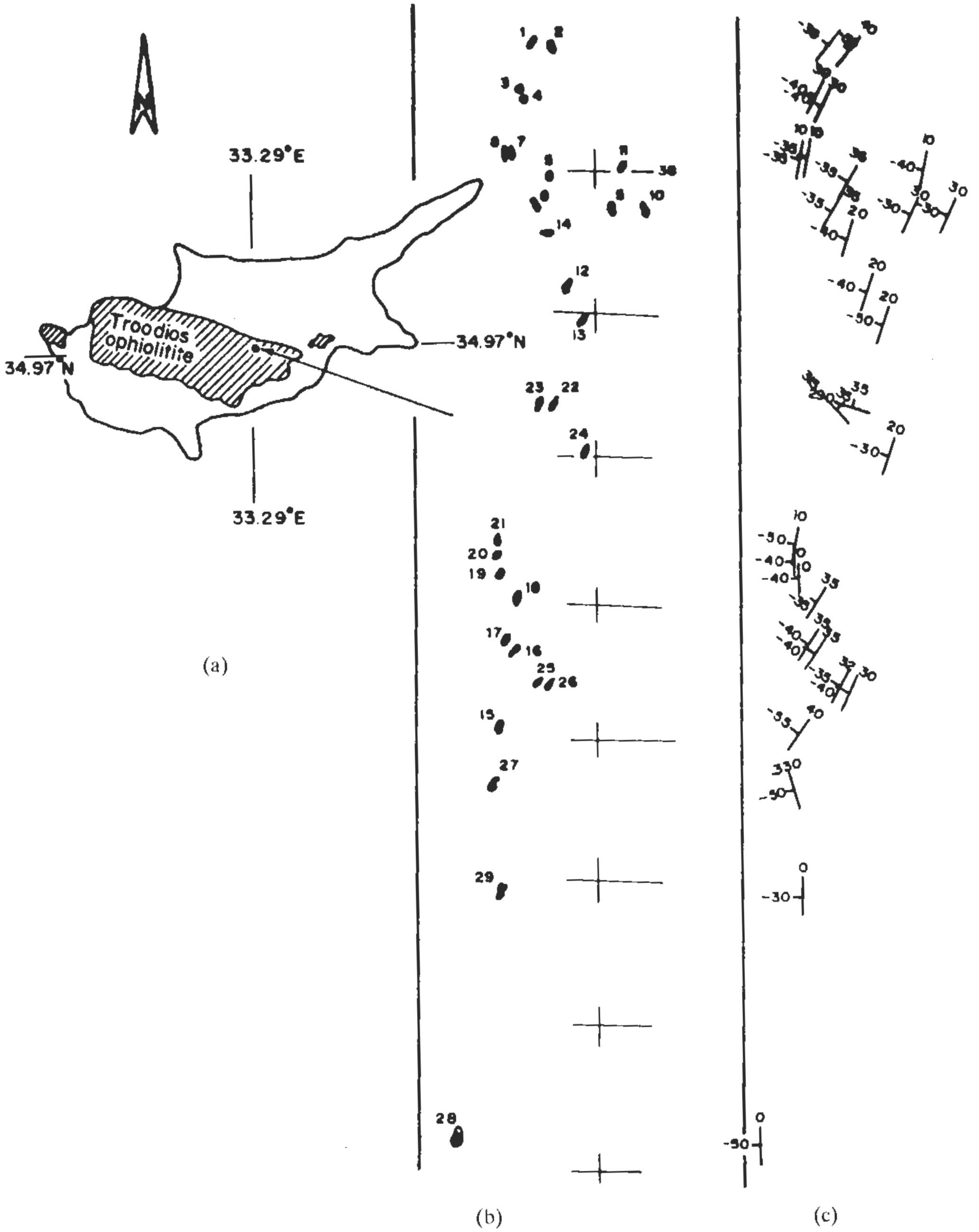


FIG. 1. (a) A sketch map of Cyprus showing the sampling locality.
(b) Sketch map of the sampling sites along a N-S profiles. Labels refers to site number.
(c) The same sketch map like (b) but with tilt of the volcanic occurrences. Strike and dip is given for each site.

TABLE 1. Palaeomagnetic data of the ofiolitic volcanic complex at Kapedhes, Cyprus (33.29°E, 34.97°N):

Site	NRM						H	CARM before tilt correction						Tilt		CARM		VGP	
No.	J mA.m^{-1}	D (°)	I (°)	n	K	α_{95}	mT	J mA.m^{-1}	D (°)	I (°)	n	K	α_{95}	strike (°)	dip (°)	D (°)	I (°)	(°E)	(°N)
Cy 1	6261.5	4.3	47.7	27	3.74	16.7	15	5752.2	289.1	83.1	20	134.4	2.8	40	-35	306.3	48.5	312.0	44.8
Cy 2	10856.9	351.5	41.3	24	9.1	10.4	15	6069.4	329.4	64.1	18	79.0	3.9	40	-50	318.6	15.2	277.6	43.3
Cy 3	9783.6	341.2	56.0	26	11.8	8.6	15	6697.9	315.1	73.3	22	84.1	3.4	30	-40	305.2	33.7	299.3	39.0
Cy 4	7508.0	4.4	57.3	27	6.3	12.0	15	3816.5	321.1	74.0	17	186.2	2.6	30	-40	306.9	34.8	299.0	40.8
Cy 5	2253.4	306.2	51.9	20	56.7	4.4	10	2066.7	295.3	54.9	19	118.4	3.1	35	-35	299.1	20.2	294.9	29.7
Cy 6	2123.2	301.6	41.9	10	26.0	9.7	15	1786.6	270.0	48.4	8	29.8	10.3	35	-36	281.5	17.5	304.2	14.5
Cy 7	3401.5	266.6	39.7	12	4.1	24.6	10	1767.6	309.6	55.2	10	66.2	6.0	10	-35	297.8	22.8	297.1	29.5
Cy 8	4165.4	280.0	55.8	12	7.6	16.9	10	2883.3	300.2	55.1	8	11.8	16.8	10	-35	292.2	21.3	299.8	29.4
Cy 9	2977.0	289.6	60.7	20	8.7	11.7	10	1790.7	278.9	60.7	16	65.3	4.6	30	-30	288.5	31.7	307.6	24.7
Cy 10	4383.3	307.4	57.7	20	28.0	6.3	10	3426.1	306.6	53.8	21	169.8	2.5	30	-30	304.3	23.9	293.6	35.1
Cy 11	3268.3	330.0	59.5	25	16.4	7.4	10	2597.5	305.0	60.2	23	46.8	4.5	10	-40	293.1	22.0	299.6	25.4
Cy 12	2876.0	293.0	49.3	14	39.4	6.4	15	1552.8	275.1	43.4	14	54.6	5.4	40	-20	282.4	26.2	307.9	17.9
Cy 13	2732.7	338.3	60.4	16	125.6	3.3	10	2005.5	334.4	63.3	16	188.8	3.4	20	-50	309.4	19.2	287.3	37.6
Cy 14	9383.8	301.0	49.5	11	11.8	13.9	10	7306.5	301.1	47.3	12	19.3	10.1	30	-30	300.8	17.3	292.4	30.2
Cy 15	5046.4	335.0	71.8	26	86.7	3.1	10	3649.2	330.1	73.3	23	74.4	3.5	40	-55	316.0	19.2	282.1	42.8
Cy 16	5632.4	328.6	69.1	16	120.2	3.4	20	877.5	313.3	73.8	8	74.8	3.6	35	-50	307.5	23.9	291.4	37.7
Cy 17	10769.2	310.9	47.5	13	49.8	5.9	15	5411.5	302.1	44.0	13	45.2	6.2	35	-30	302.9	14.0	289.3	30.8
Cy 18	4056.4	298.6	45.1	22	54.8	4.2	10	3137.4	386.0	44.5	20	70.0	3.9	35	-35	291.3	10.8	295.3	20.5
Cy 19	4662.9	314.0	52.2	8	17.2	13.8	20	861.4	318.2	42.5	8	36.5	9.3	0	-40	304.1	11.6	287.3	31.0
Cy 20	3056.8	336.4	62.9	12	22.4	2.9	20	1400.2	323.2	61.6	11	115.7	4.3	0	-40	295.9	29.4	302.0	30.0
Cy 21	3726.5	324.0	54.6	17	77.2	4.1	20	773.5	313.1	61.0	18	26.6	6.8	10	-50	295.9	14.5	294.2	25.4
Cy 22	1978.4	319.3	33.2	26	104.2	2.8	20	655.4	304.5	28.3	24	15.5	7.8	290	35	318.0	15.2	278.1	42.9
Cy 23	4194.9	326.2	33.0	15	256.0	2.4	20	534.6	326.7	22.0	14	99.7	4.0	315	35	334.0	13.6	259.8	53.1
Cy 24	3365.8	304.1	60.2	17	66.0	4.4	20	1282.3	301.5	59.0	16	40.5	5.9	20	-35	296.5	24.4	298.8	28.9
Cy 25	10433.5	301.6	38.3	14	35.7	6.7	20	4341.6	304.6	43.1	11	78.5	5.2	40	-35	306.0	8.2	284.3	31.4
Cy 26	1932.1	339.0	56.8	14	30.5	7.3	15	1201.4	300.5	64.3	10	36.3	8.1	40	-40	305.5	24.5	293.1	36.2
Cy 27	1745.2	346.0	62.8	16	160.7	2.9	25	1227.3	346.0	58.5	14	46.7	5.9	330	-50	281.9	41.2	317.1	22.6
Cy 28	2120.5	339.5	59.6	8	19.3	12.9	20	1246.6	323.8	61.0	8	20.2	12.6	0	-50	294.6	20.1	297.7	26.0
Cy 29	5011.4	297.0	51.7	10	11.8	14.6	15	2512.0	301.9	36.2	9	58.6	6.8	0	-30	295.6	9.7	292.1	23.7
means		317.2	56.6	29	23.8	5.6			306.3	56.8	29	22.8	5.7			301.2 n = 29, K = 32.3 α_{95} = 4.8	22.2		

pole without 322.9°E
tilt correction: 47.2°N

pole λ = 294.7°E 295.1°E
position: φ = 32.0°N 32.1°N

N = 29,
K = 40.7
A_{95} = 4.2

= 22.2°, n = 29, K = 32.3, α_{95} = 4.8° yielding a pole position at 294.1°E and 32.0°N (Fig. 4b, Table 1).

Petrography

The microscopic study reveals that these rocks are aphyric to sparsely phyric diabases with textures that vary from intersertal microlitic to faintly intergranular. Although the samples have suffered from oceanic-type metamorphism, primary

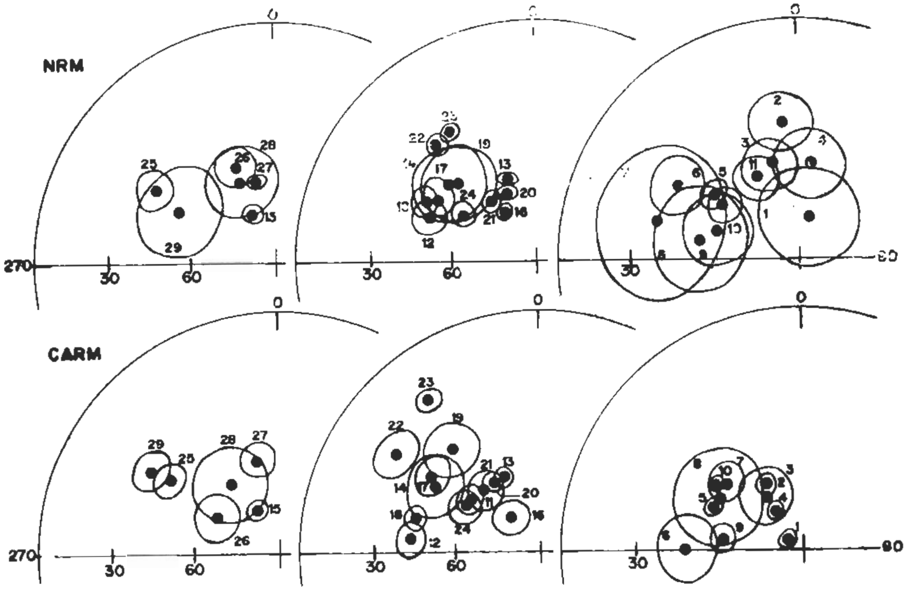


FIG. 2. (a) Upper part: Mean site directions of natural remanent magnetization (NRM) together with their α_{95} ovals.
(b) Lower part: Mean site direction of characteristic remanent magnetization (CARM) together with their α_{95} ovals. Sites are separated according to geographic positions and for clarity. Solid circles represent positive inclination.

igneous textures are preserved. Typically plagioclase lathes are clear albitic in composition with frayed edges where they may be intergrown with microgranular products from the alteration of the interstitial groundmass. Interstitial pyroxene and primary glass have been altered to a microgranular mixture of chlorite, pumpellite, actinolite, sphene and secondary magnetite.

Primary magnetites are subhedral to euhedral small grains most of which show sharp boundaries. Frayed edges however are not uncommon and result from secondary alteration of the magnetites to microgranular sphene. Internal alteration is discernible in only a few of the primary magnetites with sphene being the readily recognizable products.

Some samples are vesicular and contain more abundant chlorite and pumpellite in the groundmass alteration products. Microgranular sphene and secondary magnetite complete the alteration products of the interstitial mesostasis.

Primary magnetites are typically in size in some samples but still euhedral to subhedral with very minor of the alternation along the periphery. Few samples may have contained olivine phenocrysts which are now completely altered to iddingsite. Iddingsitization has penetrated the interstitial mesostasis.

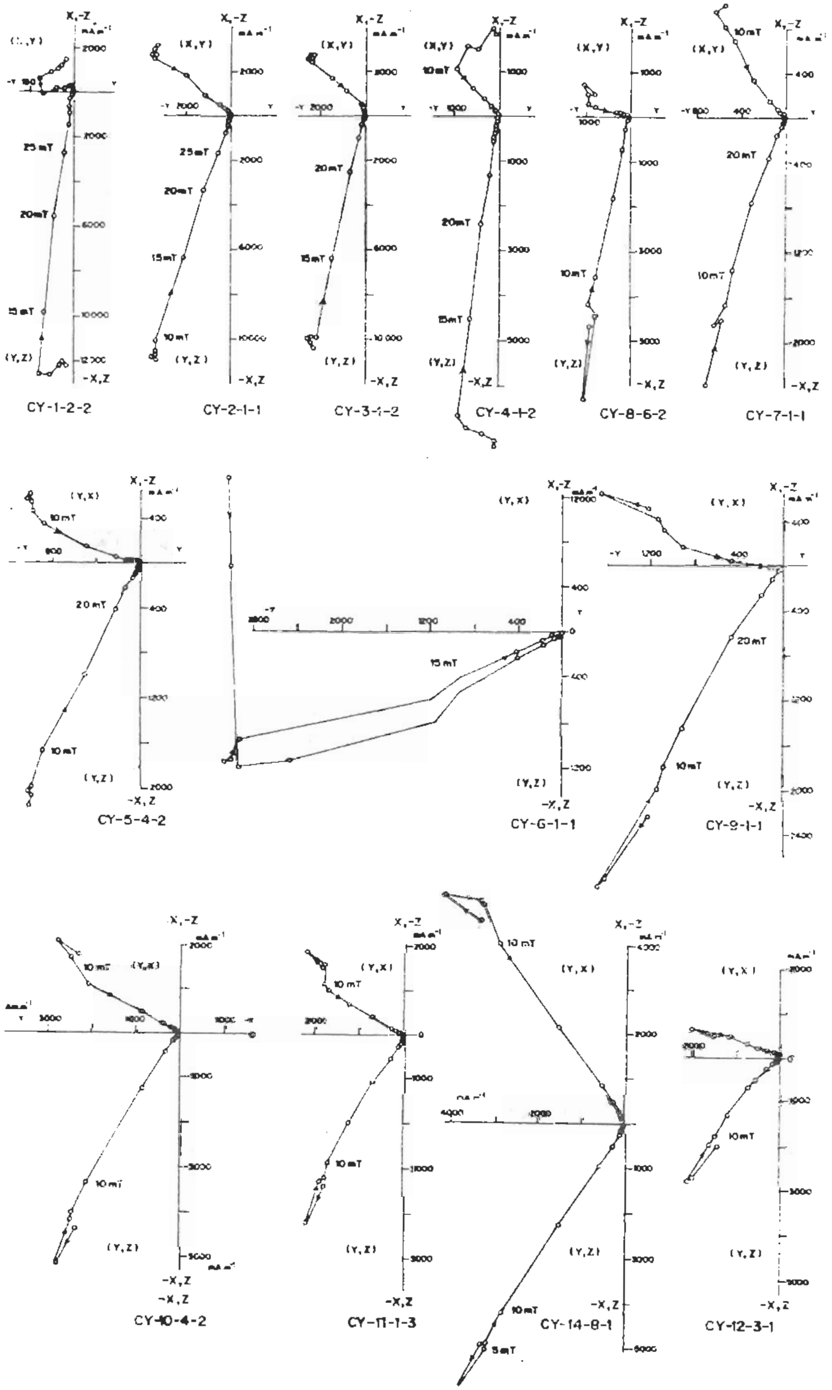
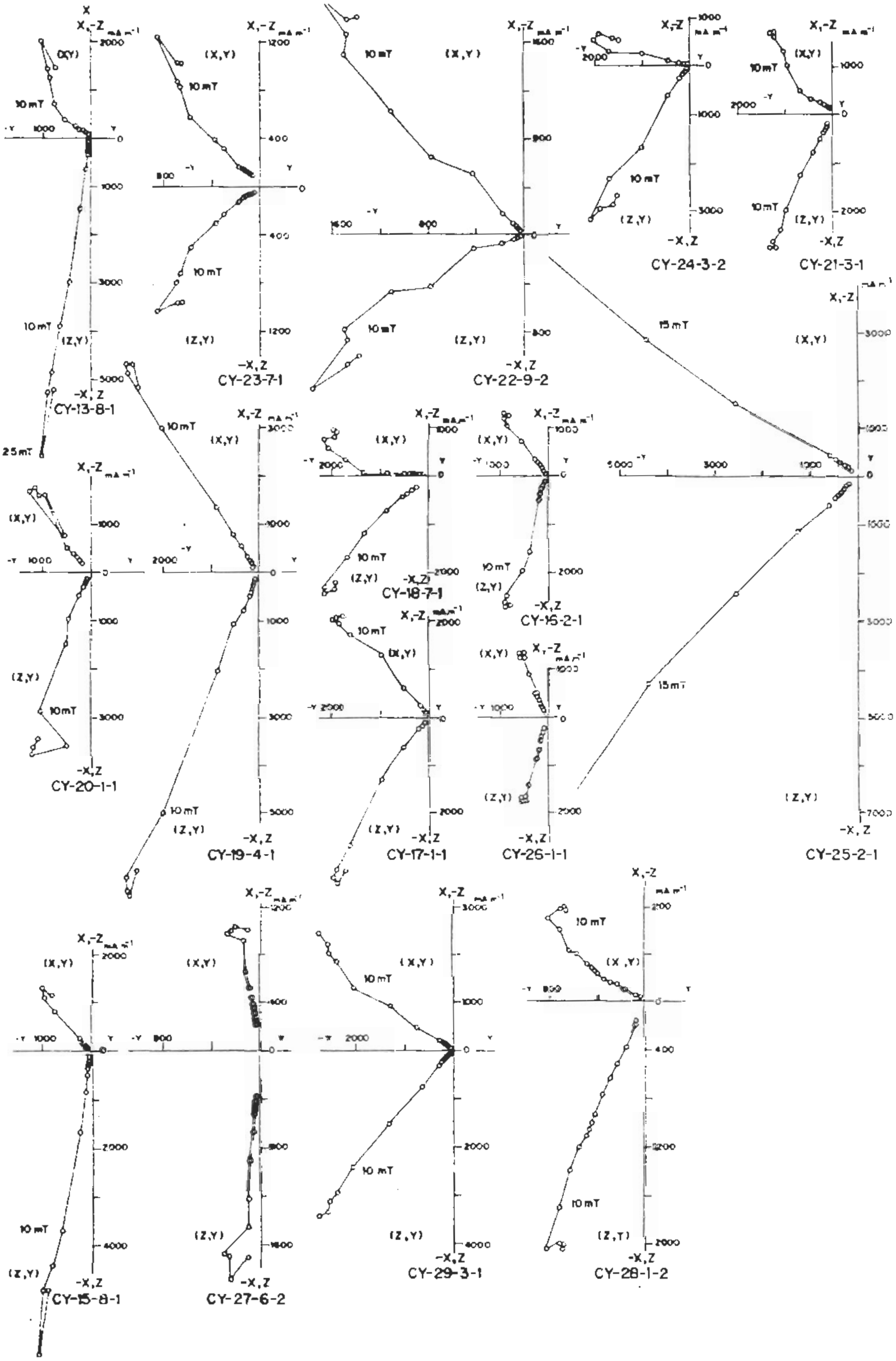


FIG. 3. Sets of vector diagrams representing the behaviour of remanent magnetization during alternating field (a.f.) demagnetization. One sample from each site is presented and samples are arranged ac-



cording to their geographic positions. All samples have stable normal directions of magnetization after a.f. demagnetization at 10 mT peak value.

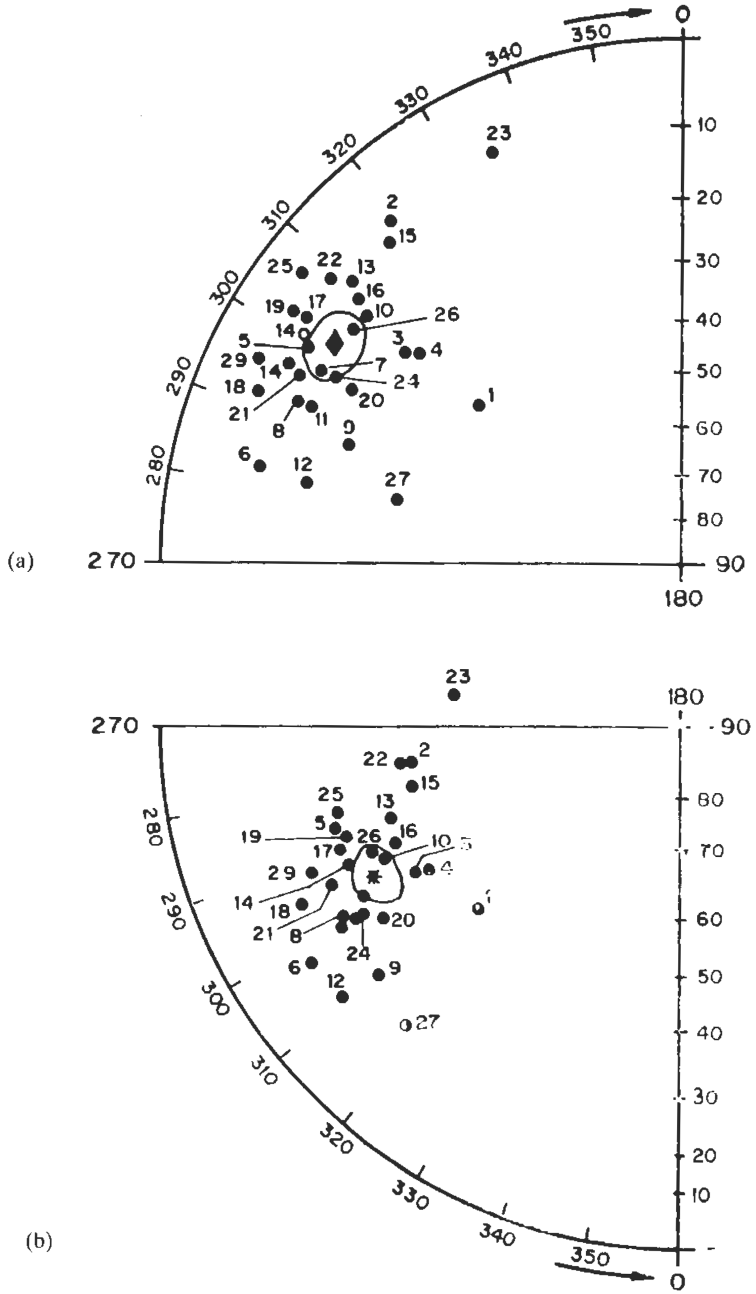


FIG. 4. (a) Equal area stereographic projections of mean site direction after tilt correction (closed circles) and mean direction of all means (diamond) together with A_{95} oval.

(b) Projections of pole positions due to each site direction and the over all mean pole position (star) and its A_{95} oval. Labels refer to site number.

Discussion and Conclusion

The sampled occurrences are lying along a N-S profile. They are striking in a general N-S trend and dipping towards West. This tilt trend is also the same as the dikes series and fault belt nearby Akapakas. The alternating field treatments indicate that there are no serious magnetic overprints. The primary magnetization, although, is rather soft (MDF 15 mT) showing low coercitivity for these volcanics (Fig. 3). The microscopic observations, in concordance, indicate fine titanomagnetite crystals ($<5\,\mu$) with some alterations at the boundaries. The mean CARM directions (uncorrected for tilting, Fig. 2b) of the northern sites (site 1 to 10) has steep inclination and western declination, while that of the central sites (sites 11 to 25) has rather shallower inclination and northwestern declination. The volcanics and further south (sites 26 to 28) have shown CARM declination and inclination similar to the northern ones. The inclination of the straight lines x versus y and z versus y components (Fig. 3) show the same change of the direction of CARM versus geographic position. This indicates that the volcanics are parts of the northwestern side of a doming volcanic sheet, the rest of which has been eroded. Corrections of the CARM direction according to the tilt parameters (Fig. 1c, Table 1) cancel both the doming effect and the intersite scatter (Figures 2b and 4a).

The mean direction of CARM (Table 1) agrees with the direction of magnetization of the pillow lava and volcano-clastics of Troodos ophiolites stated by Vine and Moores (1969), Moores and Vine (1971) and Shelton and Gass (1979). Schoenharting (1987) and Auerbach and Bleil (1987) gave nearly the same inclination for the pillow lava.

All the investigated samples have positive magnetic polarity indicatig an age of the Upper Cretaceous during the positive polarity sequence of the geomagnetic field between 110 and 80 Ma (Heirtzler *et al.* 1968 and Cox 1982). Rotating the geomagnetic pole position (Table 1) anticlockwise by an angle 33° arround a pole at 36°E, 38°N brings this pole in coincidance with the pole position of Africa of ages 110-100 Ma (Fig. 5).

The apparent pole wander path (APWP) for Africa during Mesozoic and Tertiary (Table 2) indicates a great mobility of Africa during these ages. The land masses of Africa, Cyprus, Turkey and South Europe have moved relative to each other, but they have also general motions together. The palaeopole position (295.1°E, 32.1°N, Table 1) indicates that Africa has drifted far away to the South in Mesozoic allowing the formation of Oceanic crust during 110 to 80 Ma at latitude 18-20° in the Tethyan Sea. Troodos, Antlya, Alanya, Hatay and Baer basites were formed later from these oceanic crust (Fig. 6). These low latitudes of Troodos volcanics are stated on Palaeomagnetic bases also by Vine and Moores (1969) and Auerbach and Bleil (1987). Later on, may be during Upper Cretaceous (Hussain and Aziz 1983) a northwestern movement of Africa occured, resulting in the production of the above mentioned ophiolitic bodies and forming the thick sedimentary folder Alps. Later perhaps during Early to Middle Tertiary, a southward drift of Africa occurred. This late Eocene retreation was accompanied by the rotation of Cyprus streching from

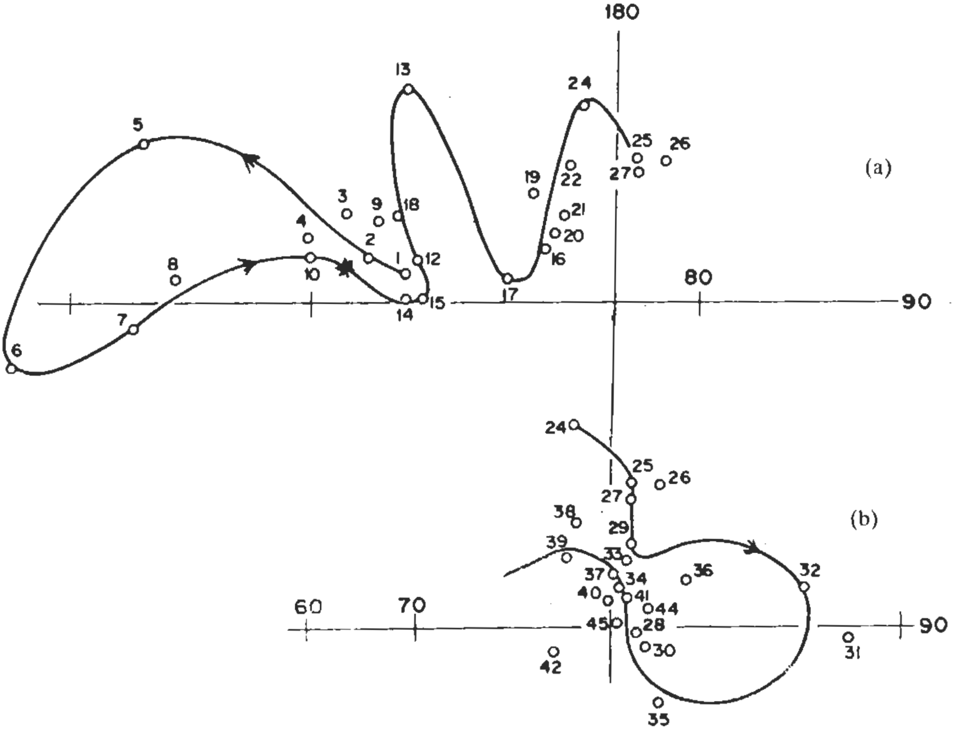


FIG. 5. Apparent pole wander path (APWP) for Africa during the Mesozoic (a) and the Tertiary (b) Cretaceous (solid lines, open circles), and Cretaceous pole position for Cyprus (solid circles, this paper) and after rotation around a pole at 36°E, 38°N by 33° (star) labels refer to pole number in Table 2. This rotated pole is very close to African poles number 10 of about 100 Ma age.

Atalya and Anaximander (Fig. 6). Also the land masses of Turkey, Lebanon and Palestine have rotated counterclockwise like Cyprus (Van der Voo 1969, and Zijderveld and Van der Voo 1973) at earlier ages than Cyprus. During late Tertiary, a rotation of the African plate towards northeast accompanied by the formation of the Red Sea graben and subduction of the African front under the Cyprus microplate. Later, in Late Miocene to present, the opening of the Red Sea occurred due to relative movement, in the same sense, between the Arabian and the Nubian plates (Girdler and Styles 1974 and Hussain and Bakor 1989).

The gravity anomalies over the Hellinic trench, and Herodotus basin indicate that the ridge is far from being of mid-oceanic nature but of thick sedimentary formation (Lort, 1977). The high positive magnetic anomalies at Eratosthenes, to the south of Cyprus (Ben Avraham *et al.* 1976), is likely due to uplift of positively magnetized Cretaceous oceanic crust along a series of normal faults.

The palaeomagnetic data of the Cretaceous and Eocene rocks from Anatolia indicate that Turkey belonged to the African plate and has rotated only 9° anticlockwise relative to Africa (Zijderveld and Van Der Voo 1973). This amount and direction of

TABLE 2. Palaeomagnetic pole positions for Africa during Mesozoic and Tertiary.

Label	Age	Pole position		A_{95}	Formation	Reference
		°(N)	°(E)			
1	T_r mean	69	263	4.9	Triassic Mean	McElhinny and Brock, 1975
2	154 - 190	65	262	11.7	Stromberg, Karoo	Hicken *et al.*, 1972
3	161 - 173	62	252	7.0	Hoachanas	Gidskehaug *et al.*, 1975
4	168	59	260	8.3	Meeteka Hills	Gough *et al.*, 1964
5	K1	44	251	10	Morrocan volcanics	Bardon *et al.*, 1973
6	122 - 162	36	277	17	Kimberlite pipes	Hargraves and Onstott, 1980
7	Mesozoic	45	273	5.5	Abu Shihat dykes	Hussain *et al.*, 1979
8	110 - 128	48	267	2	Kaoka lavas	Gidskehaug *et al.*, 1975
9	Mesozoic	65	250	11	Egypt. Mesozoic	Ressetar *et al.*, 1981
10	106 - 111	60	262	12	Lupata volcanics	Briden, 1967
11	Mesozoic	65.3	111.2	11.4	Egypt. volcanics	Ressetar *et al.*, 1981
12	77 - 100	69	258	5.8	W.Natas volcanics	Schult *et al.*, 1981
13	90	61	224	8.4	Lethose Kimberlite	Hargraves and Onstott, 1980
14	Kl - Ku	68	269	8.6	E. Oweinat Volc.	Hussain and Aziz, 1983
15	Ku	70	269	3.2	W.Natash sandstone	Hussain *et al.*, 1981
16	Ku	81	229	3.0	Fe-Ores N. Sandstone	Hussain *et al.*, 1976
17	Ku	77	258	8.6	Oweinat sandstones	Hussain and Aziz, 1983
18	63 - 92	65	249	11.4	W. Qusseir trachytes and ring complex	Ressetar *et al.*, 1981
19	Kl - Ku	75	217	5.5	Morrocan sediments	Hatwood, 1975
20	Ku u	81.5	225	8.5	Dakhla-Kharge sedimentary, Egypt	Saradeth *et al.*, 1987
21	Ku	79	208	6	Red siltstone	Gaugh and Opdyke, 1983
22	Ku ?	76	195	9	Tororo, Ring comples	Raja and Vise, 1973
23	Eocene	82	142	7.0	Bahanya Fe-Ores + S and st.	Hussain, 1977
24	Eocene-oligocene	69	189	4.6	Abu Teceifiya Basalts	Hussain *et al.*, 1979
25	25 40 MY	75	170	.	S. platau, Ethiopia	Schult, 1974
26	Tertiary	74	160	6.0	E. Oweinat Basalt	Hussain and Aziz, 1983
27	Oligocene	75	170		S.E. Ethiopia	Schult, 1974
28	Oligocene	81	168		W. Ethiopia	Brock *et al.*, 1970
29	Oligocene	78.6	81	4.7	Abu Rawash	Hussain *et al.*, 1976
30	Oligocene	75.8	70.2	2.5	Abu Zaa'bal	Hussain *et al.*, 1976
31	26 MY	64	87	3.0	Qatrani Basalt	Hussain *et al.*, 1978
32	Tertiary	68.2	101.5	12.7	Qusseir & Qatrani	Ressetar *et al.*, 1981
33	Tertiary (16)	62.6	206	16.3	Bahariya Basalts	Hussain *et al.*, 1979
34	17 (32-14)	84.6	163.3	2	Turkana (Kenya)	Reilly *et al.*, 1976
35	12 - 15	80	34	9	Narosura Magadi Kenya	Patel and Raja, 1979
36	12.9 - 13.4	81	118	17	Kapitiphon (Kenya)	Reilly *et al.*, 1976
37	11 - 13	86.5	186.6	6	Rift vally (Kenya)	Reilly *et al.*, 1976
38	10.5 - 12.3	73	195	5.6	J. Soda Lybia	McElhinny, 1977
	Tertiary	78	196			Schult and Soffel, 1973
39	6.9	83	212		Morocco volc.	
40/1	2.1 - 6.1	88	125	5	Garian basalt	McElhinny, 1977
40/2		86	152		Garian basalt	Schult and Soffel, 1973
41	1.8 - 7	86.5	147.6	2	Rift vally (Kenya)	Reilly *et al.*, 1976
42	1.6 - 6.9	84	297	4	Narosura & Magadi	Patel and Raja, 1979
43	0.4 - 2.2	84	169	7.2	Haruj Asswad (Lybia)	McElhinny, 1977
44	0.64 - 0.72	85	116	6	Marosura & Magadi	Patel and Raja, 1979
45	0 - 1.8	88.7	104	3	Rift vaily	Reilly *et al.*, 1976
46	present pole	75.5	260	–	present pole at 1965. OA.D	Wienert, 1970
	pole	78.5	291	–		

mean 24-28	75.0 172.8 , N = 5 , K - 237.2 , A_{95} – 5.0
mean 29-32	73.8 85.5 , N = 5 , K - 102.3 , A_{95} = 7.6
mean 34-39 except 35	81.3 193.3 , N = 5 , K = 209.7 , A_{95} = 5.3
mean 40-43	86.2 154.3 , N = 4 , K = 1667.5 , A_{95} – 2.3

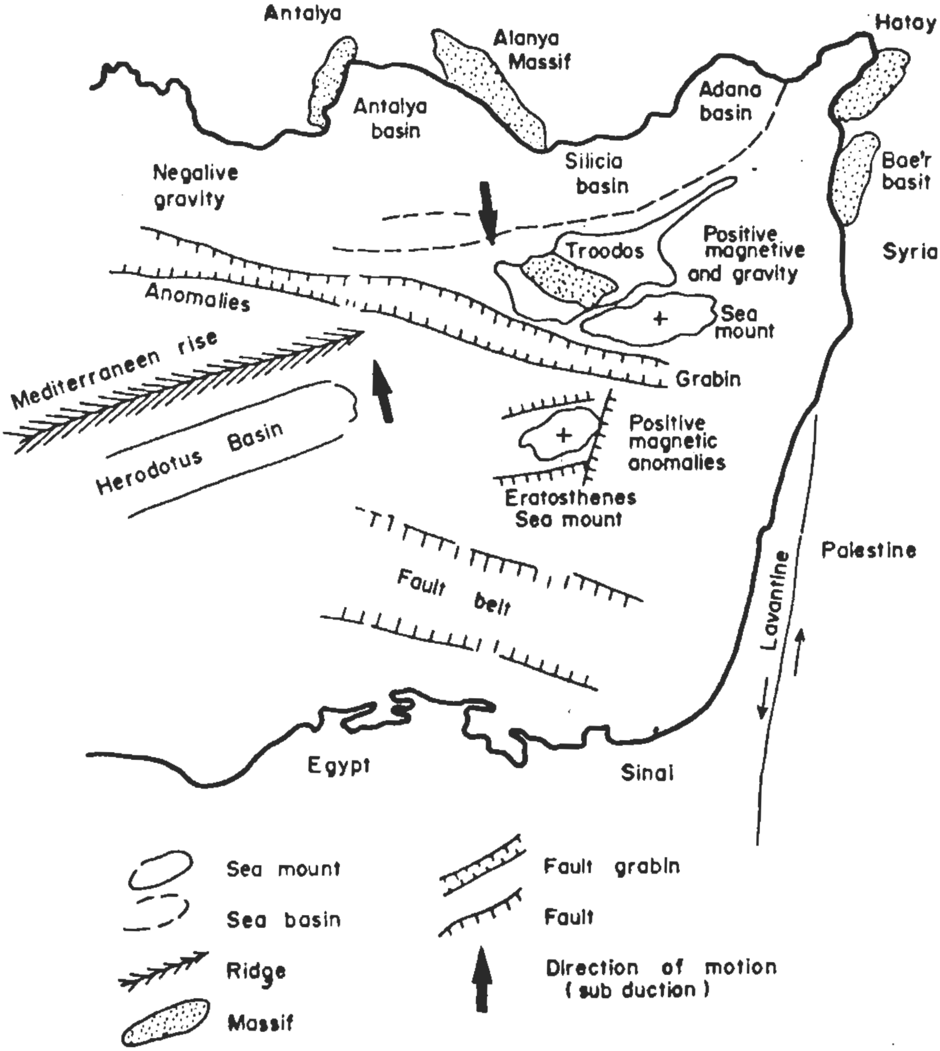


FIG. 6. Eastern Mediterranean Sea with the main tectonic features compiled after Buju-Duval *et al.* 1974, Ben-Avraham *et al.* 1976.

rotation is the same as that of the Arabian plate relative to Africa (Hussain and Bakor, 1989). Also, the palaeomagnetic data from Syria, Lebanon, and Palestine of Lower and Upper Cretaceous ages are in agreement with the African data (and in disagreement with European data) by rotating these land masses by 7° anticlockwise. This indicates that these land masses belong to the Arabian plate which in turn is a part of the African plate and that all the segments have been rotated after separation from the Afro-Arabian plate.

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باليومغنطيسية وبتروجرافية المكونات المعتمة لصخور الصفيحة البركانية الأفيوليتية من الحقب الكريتاسي عند كابيدس - قبرص

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المستخلص . أجريت دراسة باليومغنطيسية لعدد **٢٣١** عينة لب حفر موجبة جمعت من **٢٩** موقعًا من الصفيحة البركانية عند كابيدس في قبرص (خط طول **٣٣,٣**° شرقًا و **٣٥**° شمالًا) .

وقد أظهرت الدراسة أن البركانيات ذات تمغنط عالٍ (متوسط التمغنط **٥,٥** ملِّي أمبير/متر) وأن المجال المتردد الذي يُنقص هذا التمغنط إلى النصف هو مجال صغير يتراوح بين **١٢** إلى **١٥** ملِّي تسلا .

وقد أظهرت الدراسة البتروجرافية على القطاعات الرفيعة واللامعة أن حبيبات المغنيتيت صغيرة (أصغر من **٥** مكيرون) الأمر الذي يسبب السلوك المغنطيسي السابق ذكره .

وقد وجد أن جميع العينات لها تمغنط موجب مما يحدد أن هذه البركانيات طفحت في حقبة زمنية من الكريتاسي ما بين **١١٨,٨٣** مليون سنة قبل الآن ، حين كان المجال المغنطيسي الأرضي موجبا ووجد أن متوسط اتجاه التمغنط الثابت للعينات هو : انحراف : **٣٠١,٢**° وميل **٢٢,٢**° وعدد المواقع **٢٩** والثوابت الإحصائية هي : K = **٣٢,٣** و $\alpha_{٩٥}$ = **٤,٨** وأن القطب المغنطيسي في هذا الوقت يقع عند خط طول **٢٩٤,١** شرقًا وخط عرض **٣٢,٠** شمالًا .

كما وجد أن متوسطات اتجاه تمغنط البركانيات من المواقع المختلفة يدل على أن هذه الصفيحة البركانية تشكل قبوا بزاوية قدرها **٢٠**° في الشمال تتغير تدريجا حتى تصل إلى الصفر في المنتصف ، وأن محور هذا القبو في اتجاه شمال شرق - جنوب غرب وبمقارنة موقع القطب المغنطيسي لقبرص مع منحني تجول القطب لأفريقيا وُجد أن قبرص قد دارت في اتجاه عكس عقارب الساعة بزاوية مقدارها **٣٣,٣**° حول نقطة دوران تقع عند خط طول **٣٦**° شرقا وعرض **٣٨**° شمالا وهذا يحدد أن قبرص كانت جزءًا من أفريقيا عند عمر ما بين **١١٠** إلى **١٢٠** مليون سنة .