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* Institut für Allgemeine und Angewandte Geophysik, Universität München.

** Institut für Allgemeine und Angewandte Geologie, Universität München.

*** Niedersächsisches Landesamt für Bodenforschung, Aussenstelle Grubenhagen.

✱ انستیتوی ژئوفیزیک کاربردی، دانشگاه مونیخ.

✱✱ انستیتوی زمین‌شناسی عمومی و کاربردی، دانشگاه مونیخ.

✱✱✱ استانداری بندر ساکسن، اداره تحقیقات علوم زمین



agreement of this Triassic pole with the APWP of the Turan Plate indicates that the Natanz region and possibly the entire area to the West of the CEIM must be regarded as close to the southern extension of the Turan Plate during the Triassic.

5 Conclusions and geodynamic interpretation

The new palaeomagnetic investigations in Iran based on samplings between 1986 and 1992 yielded the following results: The APWP of the CEIM from the Triassic through the Tertiary could be confirmed by new data from areas within or close to the CEIM. Triassic poles from volcanic rocks of the area North of Sirjan indicate that this area must also have been rotated together with the CEIM. The new mean Triassic pole for the CEIM, derived from the results of Soffel et al. (1992), Wensink (1983) and this paper is at: 313.0 E, 12.4 N, $N=5$, $A95=16.2$. It has been named TR* in Fig. 7 and has been connected with the APWP of the CEIM with dashed lines.

The Triassic pole No. 16 from the Natanz area outside the CEIM (167.6 E, 53.6 N, $N=5$, $A95=9.3$) is in good agreement with the Triassic poles of the Turan plate (149 E, 49 N) showing that the area to the west of the CEIM was close to the Turan Plate during the Triassic.

Previously existing palaeomagnetic data for the CEIM (Soffel et al. 1992) and the data of this paper were used to reconstruct the palaeocontinental configuration of the region since the Lower Palaeozoic using published data from Gondwana (Van der Voo, 1993), the Turan Plate (Khramov and Rodionov, 1980) and the new results for the Triassic of this paper. The reconstructions shown in Fig. 8a-f have been made for various time intervals. Starting from the present situation (8a) the following ages have been selected: 100 Ma (Middle Cretaceous, 8b), 160 Ma (Middle Jurassic, 8c), 220 Ma (Lower Triassic, 8d), 280 Ma Permo-Carboniferous, 8e), 480 Ma (Lower Ordovician, 8f).

Fig. 8a indicates the present situation. Iran (J) is shown in its political borders. To the north we have a rough sketch of the Turan Plate (T). Africa and Arabia (Gondwana, G) are also presented; all other regions have been omitted in most cases. The situation at 100 Ma (Middle Cretaceous, 8b) shows Iran still in contact with the Turan Plate but separated from Arabia. This gap was closed later during the Alpine orogeny forming the Zagros fold belt. At 160 Ma (Middle Jurassic, 8c) the CEIM was at the same equatorial latitude as Arabia. The difference in longitude between the CEIM and Arabia, however, can not be determined on the basis of palaeomagnetic data. There was a significant latitudinal difference

of the CEIM with respect to the Turan Plate, combined with a rotation. For the Lower Triassic (220 Ma, 8d) two positions of Iran are presented. Iran 1 represents the CEIM with an equatorial position showing also the well known large rotation with respect to the Turan Plate. Iran 2 gives the palaeoposition of the Natanz area. It shows no rotation with respect to the Turan Plate, but a more southerly palaeoposition. At 280 Ma (Permo-Carboniferous, 8e) the CEIM is clearly separated with respect to palaeolatitude from the Turan Plate as well as from Arabia. The data suggest that an extensive shear zone has been active in the Lower Mesozoic between Arabia and the CEIM. The situation at 480 Ma (Lower Ordovician, 8f) is quite different from those of younger ages. During the Paleozoic Gondwana carried out a huge rotation by which the south pole moved across Africa to its northwestern edge. The APWP of Gondwana between the Carboniferous and the Ordovician is still a matter of dispute and several paths are still under discussion (see Van der Voo, 1993). Therefore we did not present Palaeocontinental reconstructions for this time span. In the Lower Ordovician the CEIM is situated on the southern hemisphere at a similar latitude as India thus confirming our earlier results obtained from Late Precambrian rocks of the CEIM (Becker et al, 1973). During the Lower Palaeozoic the CEIM was probably part of Gondwana, as shown in Fig. 8f. The Turan Plate was still on the northern hemisphere at shallow latitudes and was rotated with respect to its present meridian.

Our new Palaeocontinental reconstructions for Iran and the neighboring plates will certainly stimulate discussions among geologists. The reconstructions show that there is a need for more reliable palaeomagnetic data from all parts Iran to remove discrepancies between geological and palaeomagnetic evidence. It is also planned to analyze the palaeomagnetic data of other microplates in Asia and to include them in future palaeocontinental reconstructions.

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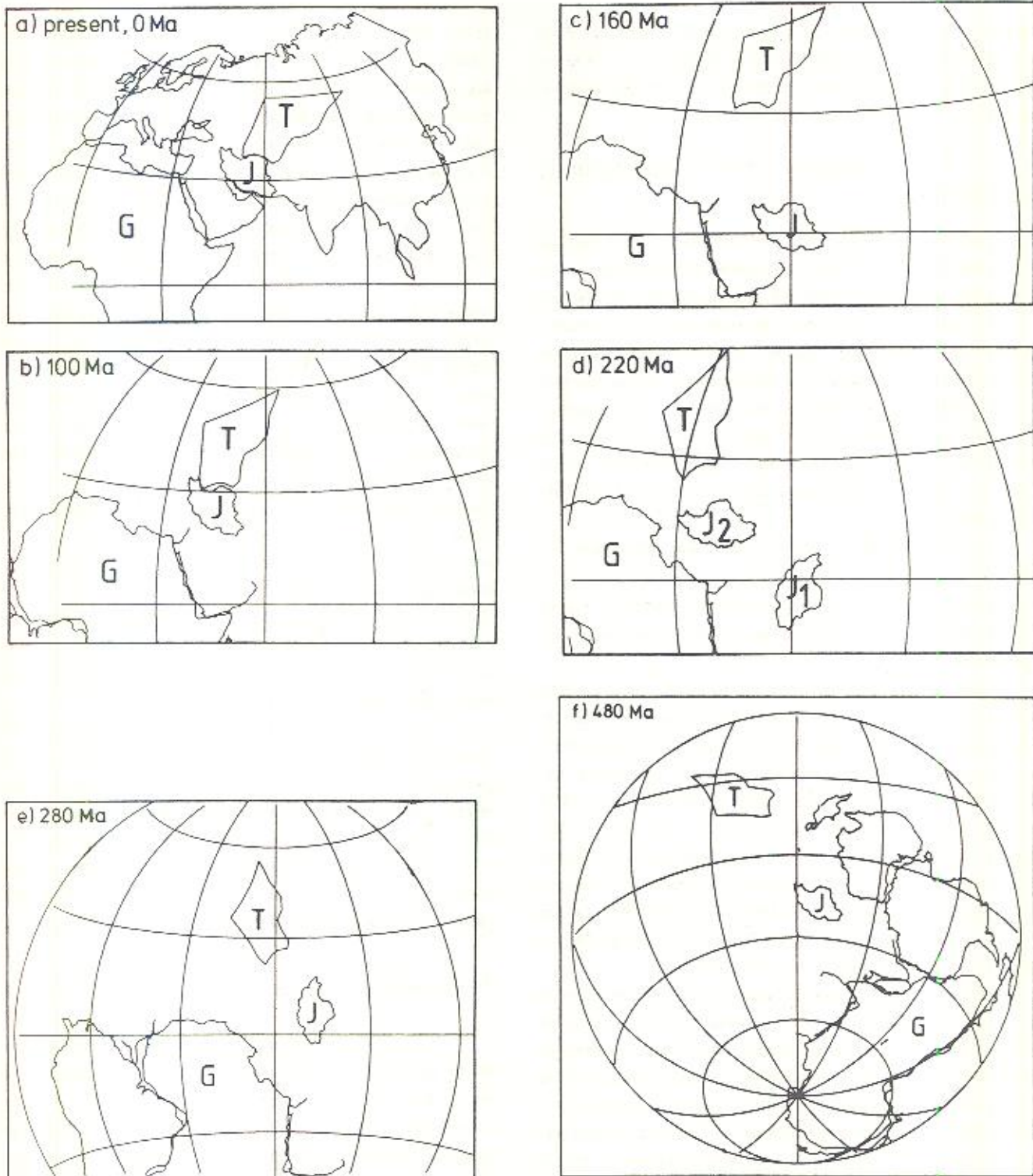


Fig. 8- Palaeocontinental reconstructions for Gondwana (G), the Turan Plate (T) and Iran (J) in its political borders representing the CEIM or the Natanz area, respectively. a) present situation; b) 100 Ma; c) 160 Ma; d) 220 Ma (J₁ = CEIM; J₂ = Natanz area); e) 280 Ma; f) 480 Ma.

Table 3- Compilation of Triassic poles for the CEIM and the area of Natanz outside the CEIM.

	CEIM Pole position		Area of Natanz Pole position	
	(°E)	(°N)	(°E)	(°N)
10-16 AF2, this paper	296.5	9.8		
10-16 TH, this paper	295.1	10.9		
33-39 TH, this paper	310.9	-3.9		
Soffel et al. (1992)	338.9	20.7		
Wensink (1982)	326.2	21.6		
This paper			167.6	53.6
Mean values:	313.0	12.4	167.6	53.6
	N=5, $A_{95}=16.2^\circ$		N=5, $A_{95}=9.3^\circ$	

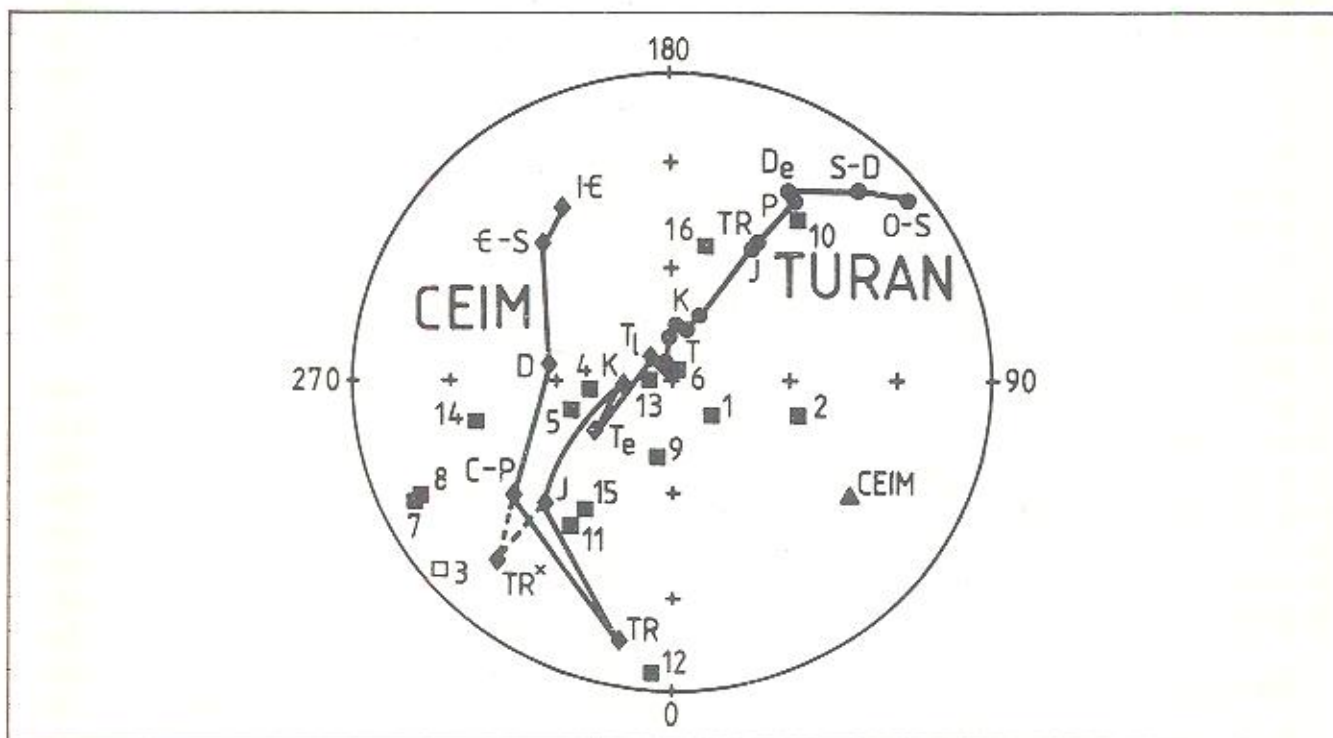


Fig. 7- Apparent Polar Wander path (North poles) of the Central- East- Iran- Microplate (CEIM, diamonds) after Soffel et al. (1992) and of the Turan plate (circles) after Khramov & Rodionov (1980) together with the new pole positions of this investigation (squares). For pole numbers see Table 2. Closed (open) symbols: Poles on the northern (southern) hemisphere. Triangle: mean geographic coordinates of the CEIM. Conventional abbreviations have been used for the geological formations using the subscripts 1 for Late and e for Early. For further details, see text.

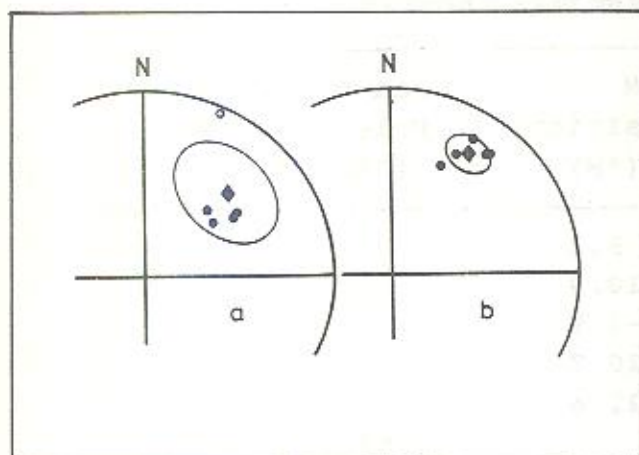


Fig. 6- Equal area projection of the mean characteristic remanence directions of the 5 sites of Triassic rocks of the Natanz area. Closed (open) symbols: positive (negative) inclination. a) Mean directions of all 5 sites before tectonic correction. b) Mean directions of all 5 sites after tectonic correction showing the reduction of the scatter and the positive fold test.

well defined ChRM directions could be determined. The mean ChRM directions of each site are also plotted in Fig. 6 before and after tectonic correction. At almost all sites two polarities of remanence could be observed passing positive reversal tests. Before tectonic correction the 5 sites have the following mean ChRM direction: $D=44.6$, $I=37.5$, $N=5$, $K=10.5$, $a95=24.8$. After tectonic correction there is only a small directional shift of the mean ($D=33.3$, $I=25.1$, $N=5$, $K=69.0$, $a95=9.3$) but the scatter is reduced considerably. The precision parameter K is improved after the tectonic correction by a factor of 6.6 which means that the fold test is positive with a probability of 99%. Therefore we regard this ChRM direction as a primary Triassic direction. The mean remanence direction of the 5 sites and the virtual geomagnetic pole position are listed in Table 2.

4 Interpretation of the pole positions

Fig. 7 shows the Apparent Polar Wander paths (APWP, north poles) of the CEIM (diamonds) and the Turan Plate (circles) together with the new pole positions of this paper (squares). Their numbers refer to the pole numbers given in Table 2. The location of the CEIM (33 N, 55 E) is indicated by a triangle.

The two Cretaceous poles (No. 1 and 2) from the Nakhlak area deviate considerably from the APWP of the CEIM. From the

behaviour of the rocks during demagnetization and from its magnetomineralogy it must be concluded that the remanence is of secondary origin. The Triassic pole (No. 3) is situated in the region where a Triassic pole has been found in earlier studies (e. g. Soffel et al. 1984) thus confirming in principle the large rotation of the CEIM since the Triassic (Davoudzadeh et al., 1981; Schmidt & Soffel, 1983). More sampling, however, is needed to verify this result. The two Cretaceous poles No. 4 and No. 5 from the Saghand area are regarded as reliable from the demagnetization behaviour of the rocks. They are close to other Cretaceous poles of the CEIM and confirm its APWP. In the Sirjan area on the southern rim of the CEIM the Triassic pole No. 6 is in good agreement with the present geographic pole and indicates a young remagnetization, possibly during the Upper Tertiary, as concluded from the few reversed directions. The other two Triassic poles No. 7 and No. 8 are situated in the vicinity of other Upper Palaeozoic- Lower Mesozoic poles of the CEIM and they are far apart from the Triassic pole position for the Turan Plate. From this we conclude that the area, where the samples originate can eventually be regarded as part of the CEIM. The area to the North of Sirjan must also have been carried out a considerable clockwise rotation with respect to the Turan Plate since the Triassic.

The presently available Triassic poles for the CEIM and for the area of Natanz outside the CEIM have been compiled in Table 3. The new more reliable Triassic pole for the CEIM based on 5 individual poles has the following data: 313.0 E, 12.4 N, $N=5$, $A95=16.2$. It is plotted in Fig. 7 as a diamond (TR*) and has been connected by dashed lines with the APWP of the CEIM as an alternative path for the Triassic.

Most of the poles derived from hand samples of the Natanz area are not reliable. Only the Eocene pole No. 9 is situated close to other Lower Tertiary poles of the CEIM and confirms its APWP. All other poles indicate remagnetization. The Early Cretaceous pole No. 10 is situated far apart from the corresponding poles of both the CEIM and the Turan plate and cannot be interpreted. Although the two Lower Jurassic poles No. 11 and No. 12 and the Triassic pole No. 14 are situated in the vicinity of other Upper Palaeozoic- Lower Mesozoic poles of the CEIM, We can not regard them as statistically significant. The Triassic pole No. 13 is clearly the result of a later (Tertiary ?) remagnetization. The Late Precambrian pole No. 15 seems to reflect eventually a Mesozoic (?) remagnetization.

Only the five localities stemming from an extended sampling of Triassic rocks (pole No. 16) gave reliable data according to the standard criteria in palaeomagnetism (sufficient number of samples, positive reversal test and fold test). The close

Zijderveld diagrams. Two of the 19 directions are reversed passing a positive reversal test. The ChRM, AF and the ChRM, TH directions are in agreement within the limits of error. We regard them as primary Triassic remanence components. The mean remanence directions and their virtual geomagnetic poles are listed in Table 2.

3.4 Natanz, area No.4

This area lies almost 150 km to the West of the CEIM. Its geology has been described by Zahedi (1973). There is stratigraphic similarity with the CEIM. From new palaeomagnetic data it was hoped to get new evidence for the geodynamic development of this area.

Sampling in the Natanz area consisted of a series of 60 hand samples covering the time interval from Late Precambrian to Eocene. We will discuss these results first before describing in detail the results of an extended sampling of Triassic rocks of this area. All mean remanence directions and their virtual geomagnetic poles are listed in Table 2.

3.4.1 Results of the hand samples of the Natanz area

The Eocene rocks consisted of 4 andesite hand samples yielding a well grouped ChRM after AF- and thermal demagnetization. It is carried by magnetite and by hematite. The mean ChRM direction is: $D = 334.5$, $I = 60.5$, $N = 8$, $a95 = 6.1$. The Lower Cretaceous rocks consisted of grey and red sandstones. While the grey sandstone were too weakly magnetic, the red variety carrying hematite as main magnetic mineral yielded the following mean ChRM direction after thermal demagnetization: $D = 58.1$, $I = 34.5$, $N = 18$, $a95 = 7.1$. Three of the 18 directions are reversed passing a positive reversal test. From the Lower Jurassic Shemshak Formation grey and green sandstones and two andesite hand samples were taken. Part of the sandstones were too weakly magnetic for further analyses. Only thermal demagnetization was successful. Two distinct groups of remanences could be identified, one of them (called Liassic-1 with $D = 126.3$, $I = -43.5$, $N = 6$, $a95 = 18.2$) from sandstones, the other (called Liassic-2 with $D = 72.4$, $I = -50.0$, $N = 14$, $a95 = 4.0$) from other sandstones as well as from andesites. The hand samples from the Upper Triassic (sandstones of the Nayband Formation) gave no results. Good data were obtained from Triassic dolomites and sandstones of the Abyaneh-Sandstone Formation. Two clearly distinct directions could be isolated after thermal demagnetization. The first direction, called Triassic-1, was obtained from AF- and thermal cleaning. Its mean direction is

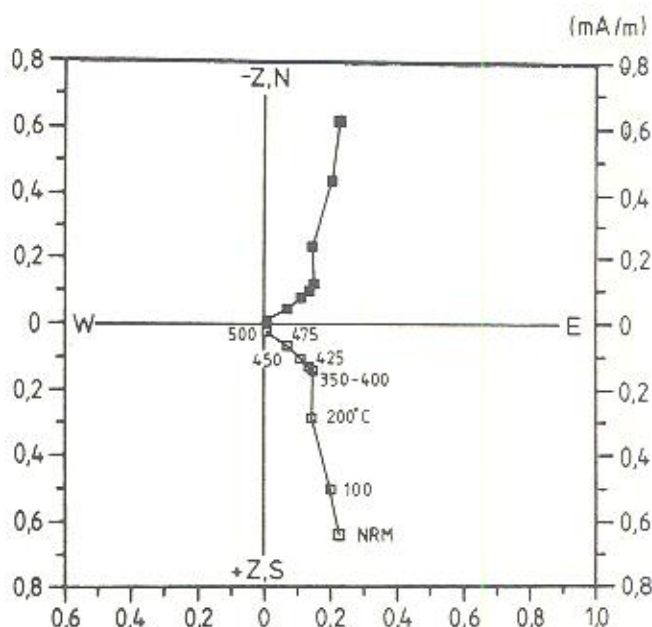


Fig. 5- Orthogonal vector plot (Zijderveld diagram) for the thermal demagnetization of a Triassic siltstone from the Natanz Area. Closed (open) symbols: projection of the remanence vector into the horizontal (vertical) plane

$D = 355.1$, $I = 46.7$, $N = 6$, $a95 = 4.6$. One of the 6 directions is reversed and passes a positive reversal test. The second direction, called Triassic-2, has the following data: $D = 320.3$, $I = -9.9$, $N = 18$, $a95 = 10.3$. It is carried by magnetite and hematite. The test samples from the Permian, the Lower Devonian, the Silurian and the Cambrian showed no consistent results, even within the same hand sample, while four volcanic samples from the Late Precambrian Kahar Formation gave the following ChRM direction after AF- and thermal demagnetization: $D = 131.3$, $I = -47.1$, $N = 14$, $a95 = 5.8$. All mean remanence directions and their virtual geomagnetic poles are listed in Table 2.

3.4.2 Results of the drill cores of the Natanz area

Very successful was the study of Triassic rocks at 5 different sites, where oriented drill cores could be taken in 1992 in a sufficiently large number. The sample collection consists of 161 specimens of Red Sandstones and Siltstones of the Abyaneh Formation, Dolomites of the Shotori Formation (both Middle Triassic) and Limestones of the Nayband Formation (Upper Triassic). Only few samples were too weakly magnetized, even for the cryogenic magnetometer. Thermal demagnetization was the best treatment for the analysis of the NRM. A Zijderveld diagram for thermal demagnetization is shown in Fig. 5. From all 5 sites



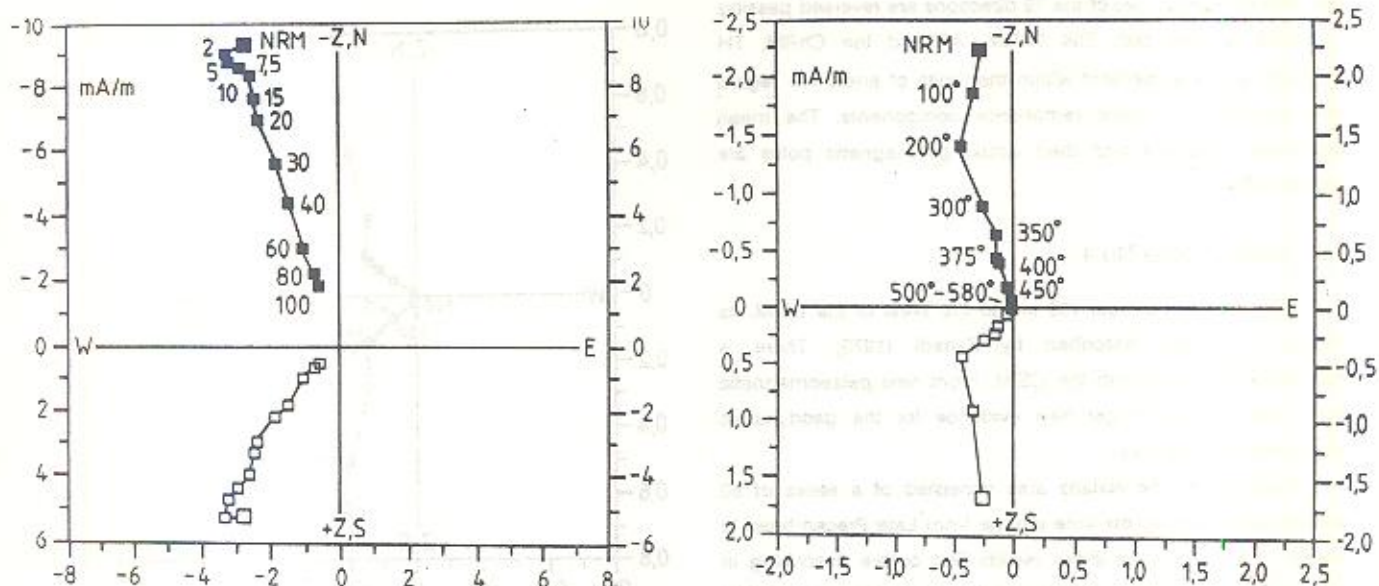


Fig. 3- Orthogonal vector plot (Zijderveld diagram) for the alternating field and the thermal demagnetization of Cretaceous limestones from the Saghand Area. Closed (open) symbols: projection of the remanence vector into the horizontal (vertical) plane. a) AF demagnetization up to 100 mT. b) Thermal demagnetization up to 580 °C.

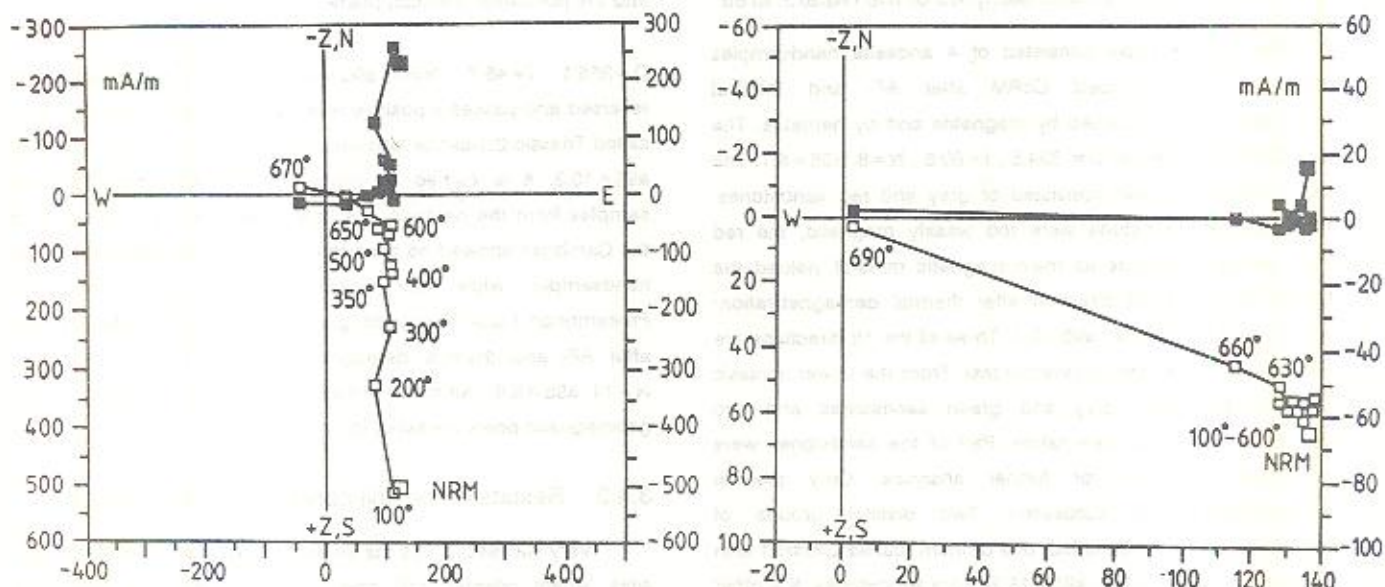


Fig. 4- Orthogonal vector plot (Zijderveld diagram) for the thermal demagnetization of Triassic volcanics from the Sirjan Area. Closed (open) symbols: projection of the remanence vector into the horizontal (vertical) plane. a) Volcanic rock with little hematite content. b) Volcanic rock with high hematite content.

(passing a positive reversal test) we think that this component is secondary because of its coincidence with typical Tertiary remanence directions in Iran. The other group of directions after AF demagnetization has a mean direction of $D=113.7$, $I=34.8$,

$N=25$, $a95=5.0$ and is called ChRM, AF2. This direction was also confirmed by thermal demagnetization in the blocking temperature range 400- 590 Yielding a ChRM, TH with $D=115.5$, $I=35.4$, $N=19$, $a95=3.9$. Fig.4 shows the corresponding

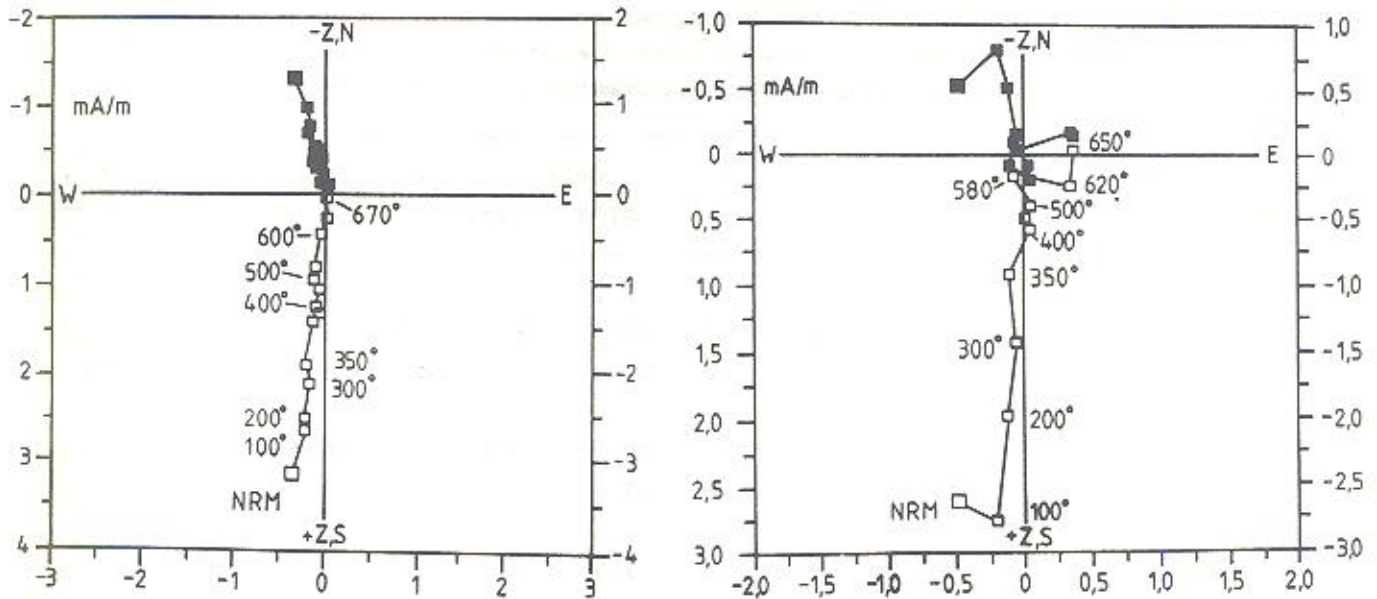


Fig. 2- Orthogonal vector plot (zijderveld diagram) for the thermal demagnetization of Triassic rocks from the Nakhlak Area. Closed (open) symbols: projection of the remanence vector into the horizontal (vertical) plane.
a) Limestone, b) Tuffite.

area. The mean NRM direction of the limestones is: $D = 221.6$, $I = 86.7$, $N = 42$, $a95 = 7.4$ and for the tuffites: $D = 340.6$, $I = 66.4$, $N = 50$, $a95 = 7.4$. They differ significantly from the present local geomagnetic field direction in Iran ($D = 5$, $I = 55$) which indicates eventually the presence of a primary Triassic remanence component. AF demagnetization was not successful for the complete destruction and analysis of the NRM. Only few samples showed a consistent but scattered grouping of directions during thermal demagnetization (see Fig. 2 for Zijderveld diagrams) in the blocking temperature range above 300 C. The mean ChRM direction was: $D = 94.0$, $I = 25.0$, $N = 12$, $a95 = 24.7$. The mean direction and its virtual geomagnetic pole are listed in Table 2.

3.2 Saghand, area No. 2

The Cretaceous limestones are slightly metamorphosed. The NRM groups with little scatter around a mean direction of $D = 346.5$, $I = +35.4$, $N = 112$, $a95 = 4.5$, which differs significantly from the present local geomagnetic field direction ($D = 5$, $I = 55$) indicating eventually the presence of a primary Cretaceous remanence component. With AF demagnetization a consistent ChRM, AF could be isolated between 10 and 100 mT with the following mean direction: $D = 345.2$, $I = 28.5$, $N = 16$, $a95 = 4.3$. It is regarded as a primary Cretaceous remanence

direction. This is supported by the thermal demagnetization experiments, where the following ChRM, TH could be determined in the blocking temperature range 300 C-590 C: $D = 338.5$, $I = 25.2$, $N = 17$, $a95 = 5.2$. Fig. 3 shows the corresponding Zijderveld diagrams. Both ChRM directions agree within the limits of error. The mean remanence directions and their virtual geomagnetic poles are listed in Table 2.

3.3 Sirjan, area No.3

The Cretaceous limestones from this area at the southwestern margin of the CEIM are mostly diamagnetic and their NRM was so weak that it could not be properly analyzed, even using the most sensitive instruments. AF demagnetization did not affect the NRM at all, while thermal demagnetization shows a sharp drop of intensity after 100 C. This indicates that the secondary mineral Goethite is the principle carrier of the NRM and primary remanence components are no more existing.

The Triassic volcanics in the Sirjan area are only slightly metamorphic. The NRM direction are very scattered. After AF demagnetization two groups of stable directions could be found. One of them, called ChRM, AF1 has an in situ direction (before tectonic correction) of $D = 3.3$, $I = +47.9$, $N = 27$, $a95 = 3.9$ and points more or less into the direction of the present local geomagnetic field. Although 5 of the 22 directions are reversed

Table 2- Palaeomagnetic results. AF: Alternating field demagnetization. TH: Thermal demagnetization. Sampling area number (see Table 1); Area; pole number; Age; Number N of specimens; Radius a_{95} of the cone of confidence; Virtual geomagnetic pole position; palaeolatitude ϕ_{pal} . * 5 sites, 161 specimens.

Area No.	Area name	Pole No.	Age	N	ChRM D (°E), I (°)	a_{95} (°)	Pole position (°E) (°N)	ϕ_{pal} (°N)
1	Nakhlak	1	AF	Cretaceous	16	15.2 54.7	9.5 131.5	77.3 35.2
1	Nakhlak	2	TH	Cretaceous	10	40.3 66.5	4.6 104.1	56.4 49.0
1	Nakhlak	3	TH	Triassic	12	94.0 25.0	24.7 310.9	-3.9 13.1
2	Saghand	4	AF	Cretaceous	16	345.2 28.5	4.3 277.0	68.1 15.2
2	Saghand	5	TH	Cretaceous	17	338.5 25.2	5.2 285.9	62.5 13.2
3	Sirjan	6	AF1	Triassic	27	3.3 47.9	3.9 153.0	87.1 29.0
3	Sirjan	7	AF2	Triassic	25	113.7 34.8	5.0 296.5	9.8 19.2
3	Sirjan	8	TH	Triassic	19	115.5 35.4	3.9 295.1	10.9 19.6
4	Natanz	9		Eocene	8	334.5 60.5	6.1 350.8	68.4 41.5
4	Natanz	10		Early Cret.	18	58.1 34.5	7.1 142.1	36.6 19.0
4	Natanz	11		Liassic-1	6	126.3 -43.5	18.2 326.6	43.0 25.4
4	Natanz	12		Liassic-2	14	72.4 -50.0	4.0 356.6	3.8 30.8
4	Natanz	13		Triassic-1	6	355.1 46.7	4.6 270.2	83.0 27.9
4	Natanz	14		Triassic-2	18	320.3 -9.9	10.3 283.8	36.2 -5.0
4	Natanz	15		Late Precam.	14	131.3 -47.1	5.8 328.2	48.3 28.3
4	Natanz	16		Triassic-3	5*	33.3 25.1	9.3 167.6	53.6 13.2

modern multicomponent analysis for the determination of the characteristic remanent magnetization ChRM as described in standard text books on palaeomagnetism (e. g Van der Voo, 1993). Both equal area stereonet and orthogonal vector plots (Zijderveld diagrams) were used for the presentation of the analysis of the NRM. Additional rock magnetic measurements (IRM acquisition curves and their demagnetization, Curie temperature measurements) were also made to determine the carrier of the most stable component of the NRM. Details can be taken from Rolf (1991) and Schmidt (1992).

3 Palaeomagnetic results

3.1 Nakhlak, area No.1

In this area we took hand samples from Cretaceous

limestones. Their NRM grouped well around the present local geomagnetic field direction. AF demagnetization up to 100 mT had little effect of the NRM. After minor tectonic corrections, a mean ChRM, AF with a mean direction of $D = 15.2$, $I = 54.7$, $N = 16$, $a_{95} = 9.5$ was obtained. With thermal demagnetization up to 670 C it was possible to destroy the NRM completely. The mean ChRM, TH direction after thermal treatment was: $D = 40.3$, $I = 66.5$, $N = 10$, $a_{95} = 4.6$. We suspect from the magnetomineralogy (presence of secondary hematite) and from other indications that the ChRM, AF as well as the ChRM, TH are of secondary origin and do not represent Cretaceous remanence directions. The mean directions and their virtual geomagnetic poles are listed in Table 2.

Triassic limestones and tuffites were collected in the same

2 Sampling areas and measurement procedures

Oriented hand samples as well as drill cores were taken in the four areas indicated in Fig. 1. Area No. 1 is situated in the Anarak-Jandaq-Block near Nakhlak and is part of the CEIM. Area No. 2 is located near Saghand and lies between the Yazd-Ardekan-Block and the Kerman-Tabas-Block, which are also part of the CEIM. The third area in the North of Sirjan is situated south of the CEIM, but still very close to it. Clearly outside the CEIM is the area No.4 in the region of Natanz. Table 1 shows the sites, geographic coordinates, lithologies and the rock ages. The tectonic setting of the sites was also determined for tectonic correction to the palaeohorizontal position and for a fold test. The characteristic remanent magnetization ChRM of the rocks determined in this paper are listed in Table 2. They include tectonic correction, if not otherwise stated.

From the oriented hand samples or from the in situ rock formation drill cores were taken, from which standard cylindrical specimens (2.5 cm in diameter, 2.2 cm in length) were obtained. They were used for the measurement of the natural remanent magnetization (NRM). This was mostly done with a highly sensitive superconducting (cryogenic) magnetometer. The NRM of the rocks was tested with respect to its stability using alternating field (AF) and/or thermal (TH) demagnetization, depending on the

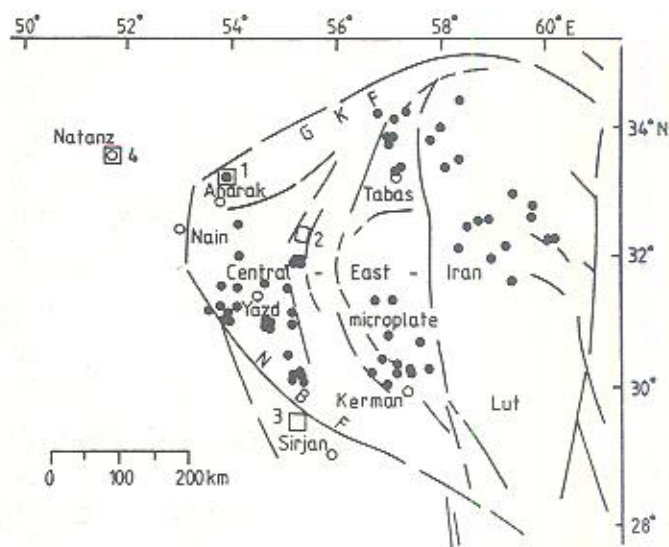


Fig.1- Schematic structural map of Central Iran showing the Central-East-Iran-Microplate (CEIM), its major fault systems and the locations of the new sampling areas. (1) Area of Nakhlak. (2) Area of Saghand. (3) Area of Sirjan- Neyriz. (4) Area of Natanz. Open circles: major cities. Closed circles: Palaeomagnetic sampling sites of earlier investigations. GKF: Great Kavir Fault. NBF: Nain- Baft Fault.

predominant ferromagnetic ores (Magnetite, Titanomagnetite, Hematite, Goethite) of the rocks. The decay of the NRM during the demagnetization treatment in field-free space was analysed using

Table 1 - List of the new palaeomagnetic sampling areas in Iran. Lat.: Latitude in ° N. Long.: Longitude in ° E.

Sampling area No.	Area name	Lat.	Long.	Lithology	Age
1	Nakhlak	33.35	54.50	Limestone Limestone, Tuff	Cretaceous Triassic
2	NW Saghand	32.5	55.3	Limestone	Cretaceous
3	Sirjan	29.4	55.1	Limestone Volcanics	Cretaceous Triassic
4	Natanz	33.35	51.70	Dolomite Limestone Sandstone Siltstone	Triassic Triassic Triassic Triassic



New Palaeomagnetic Data from Iran

By: Dr. G. Soffel* , Dr. M. Davoudzadeh **, Dr. C. Rolf ***,
and Dr. S. Schmidt *

Abstract

New Palaeomagnetic sampling was carried out in Central Iran in 1986 and in 1991-92 with the aim to extend our previous studies. Several new reliable pole positions could be obtained for the Central East Iran Microplate (CEIM) confirming the general trend of its Apparent polar Wander path (APWP) from the Triassic through the Tertiary: (i) Area of Nakhlak (33. 35N, 53.50 E), Triassic limestones and tuffs, 12 samples, $D = 94$, $O = 25$, $a_{95} = 24.7$, virtual geomagnetic pole position (VGP) at 310. 9 E, 3.9 S. (ii) Area of Saghand (32.5 N, 55. 3 E), Cretaceous limestones, 17 samples, $D = 338.5$, $I = 25.2$, $a_{95} = 5.2$, VGP at 285. 9 E, 62. 5 N. (iii) Area of Sirjan (29. 4 N, 55.1 E), Triassic volcanics, 19 samples, $D = 115.5$, $I = 35.4$, $a_{95} = 3.9$, VGP at 295.1 E, 10.9 N. Combining all Triassic pole positions for the CEIM yields a new Triassic pole at 313. 0 E, 12.4 N, $N = 5$, $A_{95} = 16.2$, which confirms the large rotation of the CEIM since the Triassic.

In the area of Natanz (33. 35 N, 51.50 E; 100 km N of Esfahan), Triassic dolomites, limestones, sandstones and siltstones (161 specimens from 5 sites) gave a mean direction of the 5 sites at $D = 33.3$, $I = 25.1$, $a_{95} = 9.3$ (passing a positive fold test on the level of 99%) and a VGP at 167. 6 E, 53.6 N, $A_{95} = 9.3$. This pole position is in fairly good agreement with the mean Triassic pole position of the Turan plate (149 E, 49 N). It indicates that the area of Natanz has not undergone the large anticlockwise rotation relative to the Turan plate since the Triassic.

in terms of palaeo- latitudes. The possible phases of continental collisions (Kimmerian and Alpidic phases) could be demonstrated. The geological consequences of our palaeomagnetic studies have been discussed by Davoudzadeh et al. (1981) and Schmidt and Soffel (1984).

With the help of the Geological Survey of Iran (GSI) it was

possible to carry out additional palaeomagnetic sampling in 1986 and 1991- 1992. Part of these samples served for test measurements on oriented hand samples in new areas of interest to investigate the suitability of various rock types for later studies. From other, more extended samplings, new palaeomagnetic data could be obtained. In this paper we give a report on all new measurements (Rolf, C., 1991; Schmidt, S., 1992), including those carried out on the test samples.

داده‌های نوین پارینه مغناطیسی ایران

نوشته: دکتر زوفل، دکتر داودزاده، دکتر رولف و دکتر اشمیت

چکیده

به منظور ادامه و تکمیل مطالعات قبلی در زمینه پارینه مغناطیسی در ایران مرکزی نمونه‌گیری‌های جدید در سال ۱۹۸۶ و سال‌های ۱۹۹۱-۱۹۹۲ صورت گرفت. چندین موقعیت جدید قطب مغناطیسی قابل اعتماد برای خرده ورق ایران مرکزی و خاوری (CEIM) به دست آمده که جهت کلی مسیر جدا بجاى نسی قطب پارینه مغناطیسی (APWP) خرده فاره را از تریاس تا پایان ترسیر تایید می‌کند.

۱- منطقه نخلک (۳۳/۳۵ درجه شمالی، ۵۳/۵۰ درجه خاوری) از آهک‌ها و توف‌های تریاس ۱۲ نمونه
 $D = 94.0, I = 25.0, a_{95} = 24.7, VGP \text{ at } 310.9 \text{ E}, 3.9 \text{ S}$

۲- منطقه ساغند (۳۲/۵ درجه شمالی، ۵۵/۳ درجه خاوری) از آهک‌های کرتاسه ۱۷ نمونه
 $D = 338.5, I = 25.2, a_{95} = 5.2, VGP \text{ at } 285.9 \text{ E}, 62.5 \text{ N}$

۳- منطقه سیرجان (۲۹/۴ درجه شمالی، ۵۵/۱ درجه خاوری) از ولکانیک‌های تریاس ۱۹ نمونه
 $D = 115.5, I = 35.4, a_{95} = 3.9, VGP \text{ at } 295.1 \text{ E}, 10.9 \text{ N}$

تلفیق همه موقعیت‌های قطبی تریاس برای خرده ورق ایران مرکزی و خاوری یک موقعیت تازه قطبی در $16.2 = 5.A_{95}, N = 12.4 \text{ E}, 313.0$ را نشان می‌دهد و در نتیجه یک چرخش زیاد برای خرده ورق ایران مرکزی و خاوری از زمان تریاس را تایید می‌کند.

در منطقه نظنز (۳۳/۳۵ درجه شمالی، ۵۱/۵۰ درجه خاوری، در ۱۰۰ کیلومتری شمال اصفهان) دولومیت‌ها، آهک‌ها، ماسه‌سنگ‌ها و سنگ‌های سیلیتی تریاس (۱۶۱ نمونه از ۵ محل) یک جهت اصلی برای ۵ محل در
 $D = 33.3, I = 25.1, a_{95} = 9.3, VGT \text{ at } 167.6 \text{ E}, 53.6 \text{ N}, A_{95} = 9.3$

را نشان می‌دهد. این موقعیت قطبی بخوبی موافق با موقعیت قطبی اصلی تریاس ورقه توران (۴۹ درجه شمالی، ۱۴۹ درجه خاوری) می‌باشد و این نشانه آن است که منطقه نظنز تحت تأثیر چرخش وسیعی که ایران مرکزی و خاوری از زمان تریاس نسبت به ورق توران پیموده است قرار نگرفته.

1 Introduction

Our previous palaeomagnetic investigations in Iran (Becker et al., 1973; Soffel et al., 1975, 1980, 1989, 1992; Davoudzadeh et al., 1981; Soffel and Forster, 1983, 1984; Schmidt and Soffel, 1983, 1984) were focussed on the Apparent polar Wander path (APWP) of the Central East Iran Microplate (CEIM). Wensink (Wensink, 1979, 1982, 1983; Wensink and Varekamp, 1980) also

contributed to the palaeomagnetic database for Iran. All data were used for the reconstruction of the drift history and rotations of the CEIM with respect to the neighbouring tectonic units (e. g. the Turan Plate in the North and Gondwana in the South). The most recent review on this subject has been published by Soffel et al. (1992). The large difference between the APWP's was interpreted