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PETROCHEMISTRY AND TECTONIC IMPLICATION OF THE UMM GHEIG FORMATION, EASTERN, DESERT, EGYPT

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SUMMARY

The Umm Gheig Formation belongs to the Abu Ziran Group of the Central Eastern Desert of Egypt. Rocks of this formation are originally derived from basalt, andesite and subordinate rhyoite. Although the formation includes two petrographic associations suffering different grades of metamorphism, however, they have close consanguineous magmatic relationship. It is suggested that these associations belonging to tholeiitic magma type which are tectonically emplaced as isand arc.

INTRODUCTION

Detailed geological mapping of the area around Wadi Umm Gheig, Eastern Desert of Egypt, reveal the occurrence of new separate formation pertaining to the Abu Ziran Group [AKAAD and NOWEIR, 1969]. This formation was named for the first time Umm Gheig Formation by EL-ANWAR [1983] after Wadi Umm Gheig where the best exposures of the formation occur around its main course.

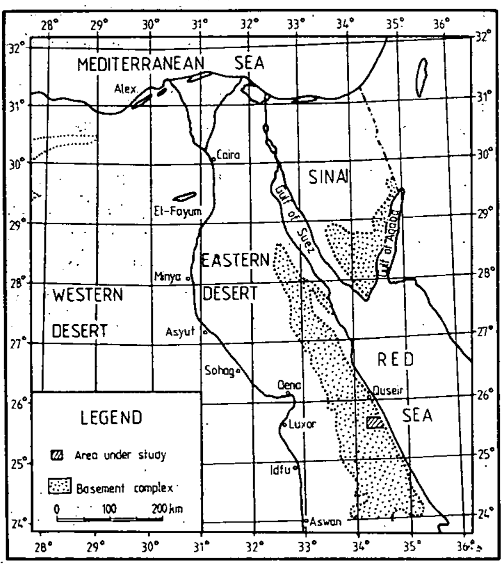


Fig. 1. Location map

The Umm Gheig Formation lies between latitudes 25° 35', 25°45' N and longitudes 34°15', 34°30' E *(Fig. 1)*. The dominant rocks of the present formation are volcanic flows and tuffs together with subordinate rocks made of tuffaceous sediments derived therefore. This association have undergone various degree o regional metamorphism including both the greenschist and epidote-amphibolite facies. Comparison of this association with the already established eight formations of the Abu Ziran Group [AKAAD and NOWEIR, 1980] reveal that the present association is different and unique. The detailed field, structure, petrography and metamorphism of this formation will be dealt with in a separate publication.

Few attempts has been carried out to elucidate the petrochemical characteristics of the metavolcanic rocks of Eastern Desert of Egypt e. g. NOWEIR and EL SHARKAWI [1978]. For the present rocks, the main objectives in this work are estimate the various petrochemical parameters and versus, define different petrographic varieties, elucidate the magma type and finally to determine their tectonic implication in light of plate tectonic framework.

FIELD OCCURRENCE AND PETROGRAPHIC CHARACTERISTIC

The Umm Gheig Formation is separated and named by EL ANWAR [1983] as new formation belonging to Abu Ziran Group. SABET [1961] considers the present rocks as a part of the metasedimentery rock of the Egyptian basement. The formation appears as a part of the Geosynclinal Metasediments in the newly published map of Geological Survey of Egypt scale: 1:2.000,000 [1981].

The Umm Gheig Formation occupies a rather irregular and extensive outcrop, covering about 185 km^2 and trending NW—SE to NNW—SSE. The best outcrops is exposed around Wadi Umm Gheig after which the formation was named.

The extreme NE part of the belt is tectonically emplaced by serpentinites and intruded by metagabbros. The northern, northwestern, south western and southern parts of the Umm Gheig Formation are later intruded by members of the Younger Granites.

The present formation is unconformably overlain by the Igla Formation in the mid-eastern side and by Micoene-Pliocene-Quaternary Red Sea coastal strip from the east.

Petrographically the Umm Gheig Formation consists of an interbedded sequence of regionally metamorphosed volcanics and their equivalent tuffs together with subordinate tuffaceous sediments. This heterogeneous sequence can be classified into two distinct associations depending on the distribution of the different rock types and the degree of metamorphism. These associations are the Wizr greenschist association and the Kab Ahmed epidote — amphibolite association.

PETROCHEMISTRY

Fifteen representative samples were selected from the belt of the Umm Gheig Formation for chemical analysis of major elements. The result are presented in Table 1.

Regarding the chemical composition of the present rocks, the cation mesonorm [WEDEPOHL, 1969] and the colour index were calculated and plotted on QAP diagram

TABLE 1

Chemical analyses (wt%) for rocks of the Umm Gheig Formation, Eastern Desert, Egypt

	Greenschist Association							Epidote-Amphibolite Association							
	Metavolcanics					Metatuffs		Schists & sub-schists	Amphibolite				Metarhyolite		
Sample no.	1	4	213	701	750	443	7	18	284	90	226	253	17	719	741
Petrographic name	Meta-andesite	Qz-H.B.-meta-andesite	Qz-biotite porphyritic meta-andesite	Metadolerite	Metabasalt with pyroxene relics	Coarse crystal metatuffs (andesitic)	Coarse crystal metatuffs (basaltic)	H.B. Qz subschist	Amphibolitic meta-andesite	Amphibolitic-metabasalt			Metarhyolite		
SiO_2	58.89	55.07	60.00	46.43	48.11	59.70	50.46	57.66	61.23	45.11	58.07	47.11	67.75	66.50	66.53
TiO_2	1.20	1.44	0.90	1.68	1.08	0.52	0.72	0.58	0.50	1.28	0.64	0.84	0.26	0.18	0.24
Al_2O_3	16.15	15.83	15.99	17.19	16.77	15.73	15.89	16.51	17.29	16.87	15.89	17.08	15.37	14.59	14.48
Fe_2O_3	3.13	4.29	3.07	2.43	1.23	4.04	4.67	1.58	3.23	5.16	3.87	3.61	1.18	1.16	0.91
FeO	4.86	5.03	5.16	9.28	10.68	3.78	7.78	3.65	3.57	8.62	6.00	7.14	2.47	4.35	6.27
MnO	0.14	0.15	0.12	0.20	0.22	0.08	0.24	0.14	0.12	0.24	0.16	0.19	0.07	0.06	0.06
MgO	2.76	4.18	2.18	7.49	7.14	2.44	3.31	5.44	2.68	7.70	2.18	7.75	1.51	1.41	1.54
CaO	5.57	5.86	5.21	10.30	10.06	4.79	8.27	7.03	5.86	10.67	5.45	9.38	4.69	3.53	3.47
Na_2O	3.37	3.57	3.71	—	1.35	5.39	3.10	5.05	3.67	2.09	3.57	2.56	3.84	2.70	2.70
K_2O	1.38	1.56	1.81	2.41	1.81	—	0.12	0.24	1.20	0.36	1.08	1.38	1.20	2.11	2.11
H_2O^+	2.10	2.44	1.36	2.48	1.01	2.93	3.46	0.87	0.54	1.44	1.46	2.47	0.98	1.39	0.83
H_2O^-	0.19	0.20	0.21	0.16	0.27	0.11	0.16	0.12	0.06	0.12	0.13	0.15	0.10	0.16	0.18
P_2O_5	0.285	0.122	—	—	—	—	0.045	0.102	0.089	0.004	0.126	0.078	0.054	—	—
Total	100.02	99.77	99.72	100.05	99.73	99.51	98.23	98.97	100.04	99.66	98.63	99.74	99.51	98.14	99.32

TABLE 2

Mesonorm and geochemical parameters for rocks of the Umm Gheig Formation, Eastern Desert, Egypt

Q	21.13	14.36	14.82	11.87	9.95	15.39	13.46	11.54	20.89	4.99	19.03	6.77	26.56	29.3	27.27
Ab	31.4	33.25	34.35	—	12.45	50.1	30.05	45.35	33.35	19.3	33.6	23.55	35.3	25.6	25.2
An	22.4	22.55	21.2	35.75	23.0	16.0	21.45	11.05	26.85	23.1	25.2	19.35	20.75	17.85	17.1
Or	—	—	11.0	—	—	—	—	—	—	—	—	—	7.25	13.2	13.0
Bi	13.52	15.36	—	23.92	17.9	—	1.2	2.32	11.52	3.52	10.72	13.44	—	—	—
HO	—	2.04	2.7	14.1	29.34	8.16	23.82	25.5	—	32.04	—	29.94	2.16	—	—
Hyp	3.58	4.42	10.68	8.04	4.04	4.86	3.02	1.18	2.42	8.48	5.48	1.12	6.04	10.48	13.98
Di	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ap	0.62	0.25	—	—	—	—	0.11	0.21	0.24	0.008	0.27	0.16	0.11		
Sph	2.61	3.12	1.95	3.66	2.31	1.11	1.62	1.2	1.05	2.76	1.41	1.8	0.57	0.39	0.51
Mt	3.39	4.65	3.3	2.66	1.32	4.37	5.27	1.65	3.42	5.65	4.23	3.87	1.26	1.28	0.99
Cor	1.35	—	—	—	—	—	—	—	0.26	—	0.05	—	—	1.9	1.96
Hem	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
C.I.	25.07	29.84	18.65	52.38	54.61	18.5	35.04	32.04	18.91	52.35	22.1	50.33	10.14	14.05	17.44
Total	100.00	100.00	100.00	100.00	100.01	99.99	100.00	100.00	100.00	99.95	100.00	100.00	100.00	100.00	100.00
si	194.58	162.70	201.96	100.88	109.78	202.31	138.48	165.74	202.17	97.67	189.34	107.31	284.46	289.31	271.95
al	31.39	27.51	31.66	23.17	22.51	31.36	25.65	27.92	33.58	21.49	30.51	22.89	37.96	37.34	34.82
fm	35.21	40.79	33.57	48.02	47.28	33.57	41.59	35.94	31.43	49.38	36.91	46.57	22.12	28.98	33.80
c	19.72	18.55	18.79	25.28	24.60	17.39	24.32	21.65	20.73	24.75	19.06	22.89	21.10	16.46	15.20
alk	13.69	13.15	15.98	3.52	5.62	17.68	8.44	14.49	10.26	4.38	13.53	7.65	18.82	17.23	16.19
k	0.21	0.22	0.24	1	0.47	—	0.02	0.03	0.18	0.11	0.17	0.26	0.17	0.34	0.34
mg	0.39	0.45	0.33	0.54	0.52	0.37	0.33	0.65	0.42	0.51	0.29	0.57	0.43	0.32	0.28
qz	39.82	10.1	38.04	−13.2	−12.7	31.59	4.72	7.78	45.13	−19.85	35.22	−23.29	109.18	120.39	107.19
ti	2.97	3.19	2.27	2.89	1.85	1.32	1.48	1.25	1.24	2.08	1.57	1.44	0.82	0.59	0.74
p	0.40	0.15	—	—	—	—	0.05	0.12	0.12	0.003	0.17	0.08	0.095		
Rittmann's Suite I.	1.42	2.18	1.79	1.69	1.95	1.74	1.39	1.91	1.30	2.84	1.43	3.78	1.03	0.98	0.98
W. Alkalinity Ratio	1.90	1.98	2.08	1.19	1.27	3.21	1.69	2.50	1.93	1.20	2.01	1.35	2.24	1.85	1.86
Larsen's D.I.	10.86	7.51	12.86	−3.61	−2.99	10.67	3.15	3.56	10.94	−7.17	11.31	−4	15.97	18.57	18.8
Thornton & Tuttle's D. I.	52.53	47.61	60.17	11.87	22.4	65.49	43.51	56.89	54.24	24.29	52.63	30.32	69.11	68.1	65,47
FeO/MgO	2.78	2.13	3.63	1.53	1.65	3.04	3.62	0.39	2.42	1.72	4.35	1.34	2.34	3.82	4.60
F_2	−1.32	−1.319	−1.292	−1.24	−1.36	−1.47	−1.39	−1.555	−1.367	−1.47	−1.323	−1.39	−1.357	−1.207	−1.23
F_3	−2.422	−2.406	−2.43	−2.297	−2.336	−2.442	−2.268	−2.56	−2.492	−2.319	−2.348	−2.373	−2.499	−2.369	−2.375

of STRECKEISEN [1967] *(Fig. 2)*. The plots reveal that the rocks of the Umm Gheig Formation compositionaly have three main petrographic equivalents:

a) Basalt and andesite (Field 10)
b) Qz-andesite (Field 5)
c) Rhyolite (Field 3a).

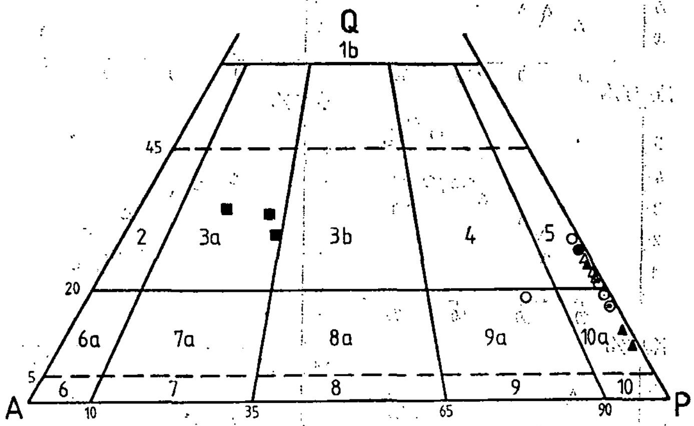


Fig. 2. Distribution of the rocks of Umm Gheig Formation in the QAP diagram [STRECKEISEN, 1967].

Wizr Greenschist Association		*Kab Ahmed Amphibolite Association*	
Metadolerit and metabasalt	△	Amphibolite (basaltic)	▲
Metaandesite	○	Amphibolite (andesitic)	●
Metatuffs (basaltic)	△	Subschist (andesitic)	⊗
Metatuffs (andesitic)	⊙	Metarhyolite	■

For delimination between basalt and andesite, STRECKEISEN (op. cit. p. 182) has suggested a delimitation by colour index at M=40 as limit. BARTH [1931] has given preference to colour index at the limit M=35 (see Table 2).

The characteristics of the distribution of the major oxides in the rocks of the Umm Gheig Formation can be investigated by variation diagrams. On plotting the chemical analysis of the major oxides *versus* Thornton and Tuttle's D.I. *(Fig. 3)* several characteristics can be denoted.

a) Plots for SiO_2, Na_2O, FeO*, CaO and MgO with D.I. shown linear trends *(Fig. 3, a, b, d, e, f)*.

b) Plots for SiO_2 and Na_2O are well positively correlated with D.I. *(Fig. 3, a, b)*.

c) Plots of CaO, MgO and FeO are negatively correlated with D.I. *(Fig. 3, e, f, d)*.

d) Plots belong to the amphibolitic samples (amphibolite of basic and intermediate origin, Nos. 90, 253) confirm well to the smooth descending trend *(Fig. 3, a, b, d, e* and *f)*.

e) Potash is weakly positively correlated with D.I. *(Fig. 3c)*.

Denotion *a, b* and *c* nicely reveal close consanguineous magmatic relationship for the present rocks. Denotion *d* confirms the ortho-origin of the present amphibolites. Denotion *e* donates partial migration or addition of potash for some samples during processes of alteration and metamorphism.

Larsen's variation diagram of the studied rocks is shown in *Fig. 4*. The percentage frequency of the individual elements are plotted on ordinate *versus* the corresponding

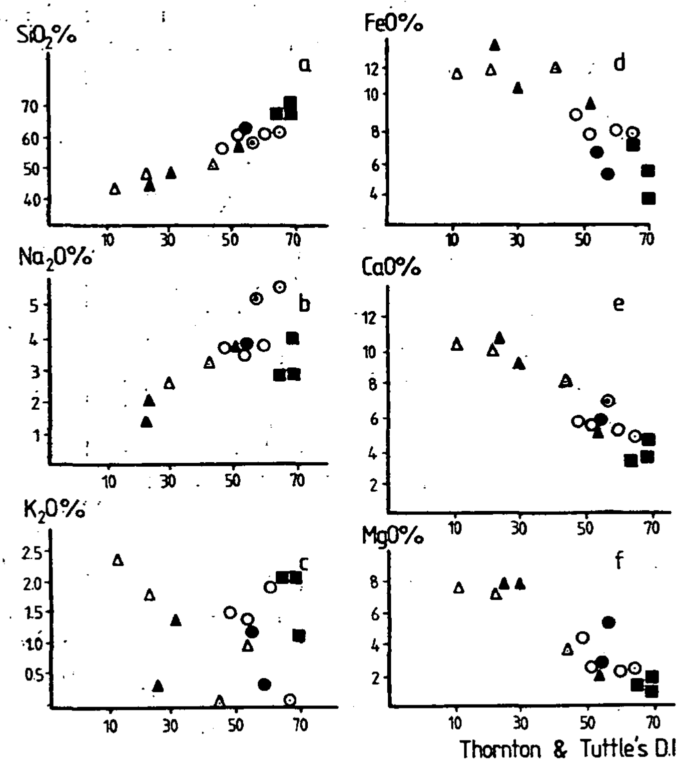


Fig. 3. Variation diagrams of major oxides *vs* differentiation index (D.I.) according to THORNTON and TUTTLE [1960] for samples from Umm Gheig Formation. Symbols as in *Fig. 2*.

"differentiation index, D.I." on the abscissa (D.I. $=(\frac{1}{3}$ Si$+$K$)-($Ca$+$Mg$)$. The figure indicate typical continuous magmatic trend of the present rocks, i. e., with proceeding the magmatic differentiation Si and Na regularly increase whereas Mg and Ca linearly decrease. Out of these regular trends potash is exceptionally varied that is attributed to either later potash metasomatism and/or migration of K during regional metamorphism.

Fig. 5. Alkalies — silica variation diagram for rocks of the Umm Gheig Formation. The broken line means the boundary between alkalic and tholeiitic basalts in Hawai [McDONALD and KATSURU 1964], the solid line gives the boundary between alkalic and non-alkalic volcanic rocks in Japan Kuno, 1966].
1. Oceanic tholeiitic basalt, 2. continental tholeiitic basalt, 3. oceanic alkalic basalt, 4. continental alkalic basalt (1—4 according to LOESCHKE, 1976), 5. island arc tholeiitic basalt, 6. island arc tholeiitic andesite, 7. island arc tholeiitic dacite (5—7 according to JAKES and WHITE, 1972). Symbols as in *Fig. 2*.

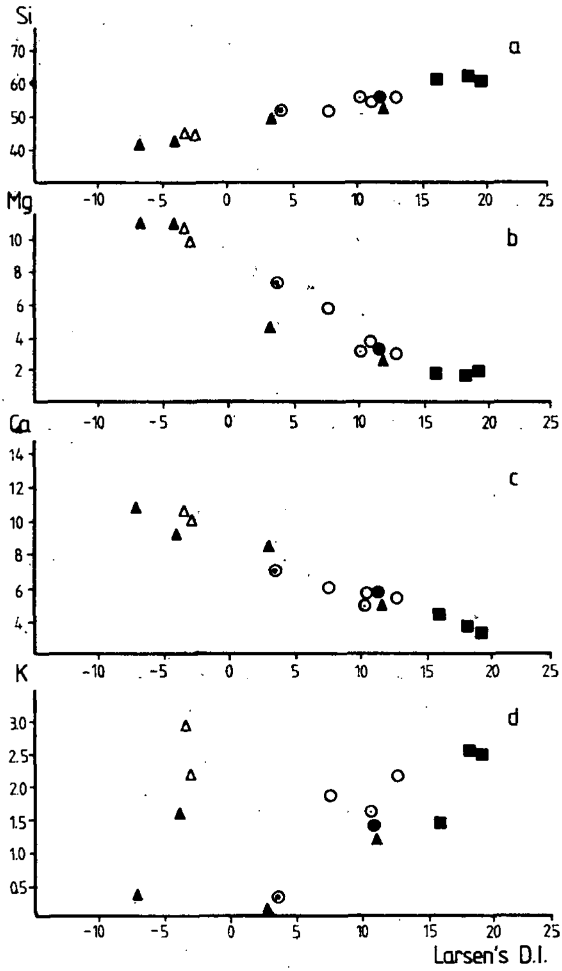
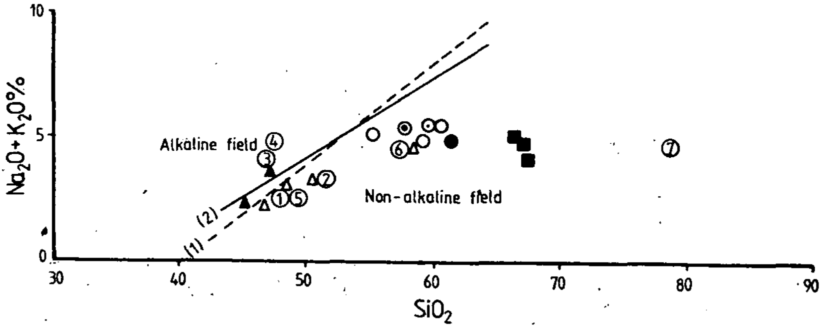


Fig. 4. Variation diagrams of Si, Mg, Ca and K per cent *vs* differentiation index (D.I.) according to LARSEN for samples from Umm Gheig Formation indicating co-magmatic differentiation. Symbols as in *Fig. 2*.



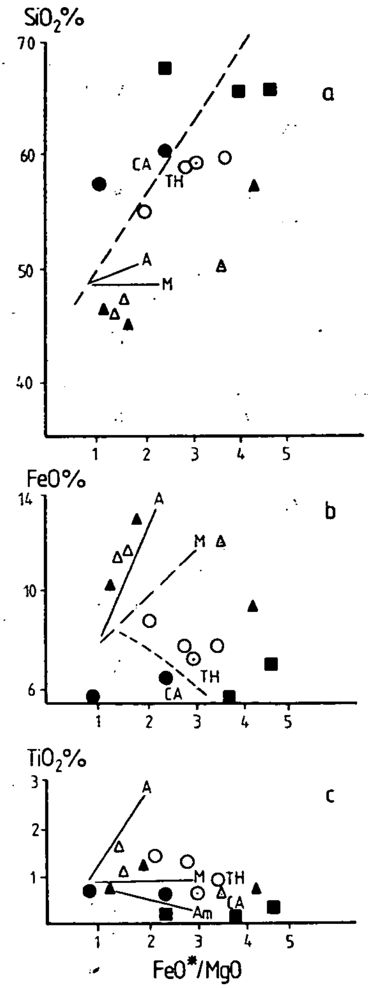


Fig. 6. Variation diagrams of TiO_2, FeO, SiO_2 *vs* FeO*/MgO for rocks of the Umm Gheig Formation. FeO* means the total iron as FeO. The field boundaries separate the tholeiitic (TH) and calc-alkaline (CA), and the trend lines for abyssal tholeiites (A), Macauley Island arc tholeiite series (M) and the Amagi calc-alkaline series (AM) after MIYASHIRO [1975b). Symbols as in *Fig. 2.*

Non-alkalic volcanic trend of the Umm Gheig Formation:

Plotting the present analyses on the alkali-silica variation diagram *(Fig. 5)* reveals that all the volcanic rocks under consideration (with one exception) fall within the non-alkalic field (the field of tholeiite according to IRVINE and BARAGER, 1971). The exceptional sample plot just above the dividing line, which is most probably due to the low silica and high potash content of that sample (see *Fig. 3c* and *4d).*

The non-alkalic affinity of the present rocks is simillar to affinites for most of the metavolcanic rocks of the Central Eastern Desert [NOWEIR and EL SHARKAWI, 1978, and TAKLA and SHENOUDA, 1981].

Predominance of tholeiite magma type in Umm Gheig Formation:

MIYASHIRO [1975 *a, b)* has classified the volcanic rock series of the Earth into alkalic and non-alkalic groups. The latter may be subdivided into tholeiitic (TH) and calc-alkalic (CA) series. FeO*/MgO *versus* SiO_2, FeO*/MgO *versus* FeO* and FeO*/MgO *versus* TiO_2 diagrams were proposed by MIYASHIRO [1973] to distinguish between tholeiitic and calc-alkaline volcanic series. The above mentioned diagrams are widely used for fresh as well as metamorphosed volcanic rocks, e.g. GALE, [1975], FURNES *et al.*, [1976].

Plotting the chemical data of the Umm Gheig Formation on Miyashiro's diagram *(Fig. 6)* indicate that almost all plots lie within the tholeiitic field.

IRVINE and BARAGER [1971] have demonstrated the usefulness of triangular diagram with Mg, FeO* and Na_2O+K_2O at the corners (AFM) to discriminate the tholeiitic and calc-alkalic volcanic rocks. The present data are presented on (AFM) diagram *(Fig. 7)*, they firmly indicate that most of rocks of the Umm Gheig Formation were the product of originally tholeiitic volcanic rock.

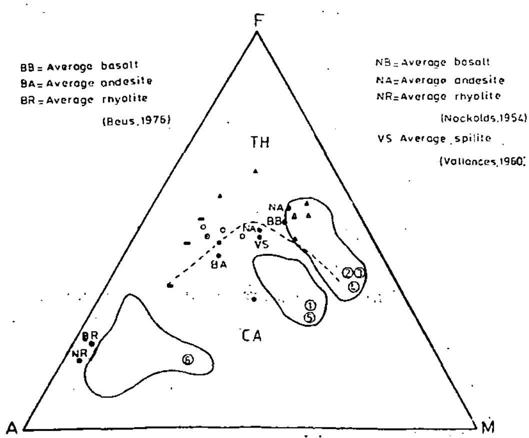


Fig. 7. Rocks of the Umm Gheig Formation plotted on AFM variation diagram ($A=Na_2O+K_2O$, F=FeO (total Fe), M=MgO. The field boundary separating the tholeiitic (TH) and calc-alkaline composition is after IRVINE and BARAGAR [1971]. Compositional fields (1—6) are after NOWEIR and EL-SHARKAWI [1978]:

1. Eraddia Formation A
2. Um Seleimat Formation
3. Sukkari Formation
4. Muweilih Formation
5. Eraddia Formation B
6. Atalla Formation

Symbols as in *Fig. 2*.

Petrochemical correlation with other metavolcanic rocks of North Central Eastern Desert of Egypt:

By using AFM and $FeO—Fe_2O_3—TiO_2$ ternary diagrams constructed by NOWEIR and EL SHARKAWI [1978] for differentiation between the metavolcanic rocks of North Central Eastern Desert of Egypt, the present rocks overlap the fields of the Um Seleimat Formation, the Sukkari Formation the Muweilih Formation and part of the Eraddia Formation field, *(Fig. 7, 8)*.

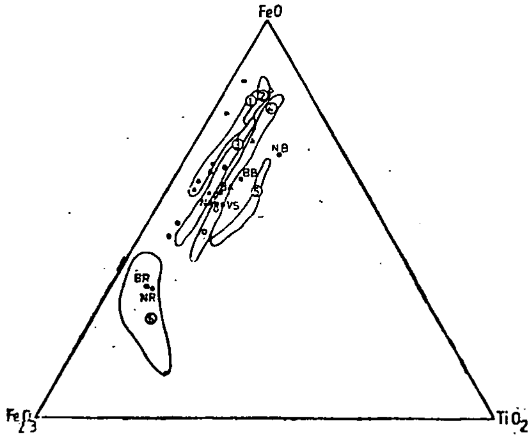


Fig. 8. FeO—Fe_2O_3—TiO_2 ternary diagram showing field of location of the Umm Gheig Formation with respect to published metavolcanic formation of Eastern Desert, Egypt. Symbols as in *Figs. 2* and *7.*

Tectonic implication of the Umm Gheig Formation:

It is clear that there is a close relationship between different types of volcanic rocks and their tectonic setting. After the establishment of tholeiitic volcanic trend for the rocks of the Umm Gheig Formation it is neccessary to find out the possible original tectonic environment on the light of plate tectonic theory.

Unfortunately, tholeiitic magma exist in large quantities in island arc sequences, but they also occur in oceanic rift environment (abyssal tholeiities) and as continental floor basalt [JAKES and GILL, 1970 and MIYASHIRO, 1974].

Throughout the literature survey, the geochemical methods are the most effective in discriminating different tectonic setting of volcanic rocks. Applications of these methods for rocks of the Um Gheigh Formation might help in deducing the past-tectonic environment prevailing during their eruption.

The preliminary impression about the tectonic implication of the present rocks is taken from alkali-silica variation diagram *(Fig. 5)*. In this diagram the present rocks appear much more similar to tholeiitic rocks developed in island arcs [JAKES and WHITE 1972] than any other tholeiitic type of different tectonic setting.

FLOYD and WINCHESTER [1978] and other, have demonstrated that TiO_2 is one of the immobile elements during post-consolidation alteration processes (e.g. spilitic alteration, metamorphism) that is significantly used in constructed diagrams for the identification of ancient volcanic suite and comparing them with the recent volcanics. MIYASHIRO [1975*a*] indicates that the abyssal tholeiites show a higher rate of increasing of TiO_2 with increasing FeO^*/MgO than do island arc tholeiitic rocks. *Fig. 9* represents the composition fields of abyssal tholeiites and island arc volcanic rocks constracted by MIYASHIRO (op. cit). This figure confirms the island arc tectonic setting for rocks of the Umm Gheig Formation, since all present plots are completly enclosed within the field of island arc volcanic rocks.

MIYASHIRO [1975*b*], used the Na_2O/K_2O *versus* Na_2O+K_2O diagram for old metamorphosed rocks (e.g. Franciscan terrane) in order to clarify both alkali

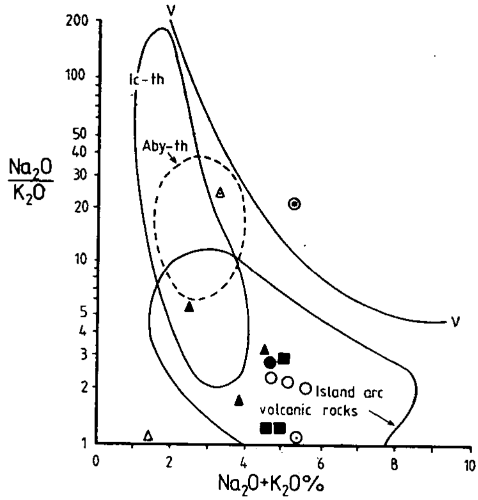


Fig. 9. Na_2O/K_2O *vs* Na_2O+K_2O diagram for rocks of Umm Gheig Formation. V——V curve represents the upper limit for all fresh volcanic rocks, Ic-th means the field of Icelandic tholeiites, and Aby-th that of the abyssal tholeiites after MIYASHIRO [1975*b*]. Symbols as in *Fig. 2.*

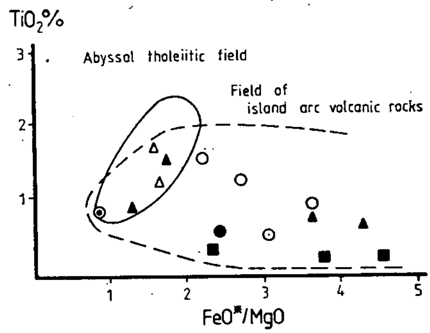


Fig. 10. Composition field of abyssal tholeiites and island arc tholeiites in diagram of TiO_2 *vs* FeO/MgO after MIYASHIRO [1975*a*]. Symbols as in *Fig. 2.*

migration during metamorphism and past-tectonic environments for these rocks. Using the above diagram *(Fig. 10)* it shows that rocks of the Umm Gheig Formation lies below the V—V indicating little migration of alkalies during metamorphism. It also shows that the present rocks behave similar to the island arc volcanic rocks of the Franciscan terrane.

PEARCE [1976] compiled large number of major element oxides analyses for the basaltic rocks from different tectonic settings. By using discriminant function it was possible to represent visually the separation of six tectonically defined magma, (OFB) ocean-floor basalts, (LKT) island arc tholeiites, (CAB) calc-alkalic basalt, (SHO) shoshonites, (OIB) ocean island basalt, and (CON) continental basalt.

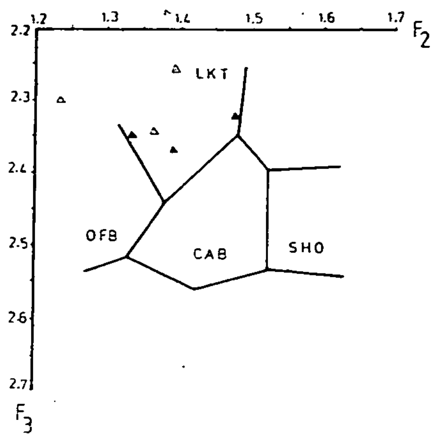


Fig. 11. Plot of discrimination functions F_2—F_3 [Pearce, 1976] for rock varieties of the Umm Gheig Formation.
LKT = island arc tholeiites
OFB = ocean-floor basalt
CAB = calc-alkaline basalt
SHO = shoshonites.
Symbols as in *Fig. 2.*

Application of the Pearce's numerical method to lavas of unknown tectonic setting of the Archean metabasalts gives the mostly geological consistant results.

The chemical analysis for rocks of the Umm Gheig Formation are treated on the basis of Pearce's discrimination method where F_2 and F_3 were calculated (Table 2). Rock varieties have basaltic and quartz-basalt original composition are plotted well inside island arc tholeiitic field (LKT) *(Fig. 11).*

Generally, the mechanism of continental growth [Hamilton, 1970], has contributed the addition of primary, but relatively highly fractional sialic material in the form of andesite basalt volcanism in island arcs.

Finally, on the basis of major element pattern, it is here highly suggested that the present tholeiitic volcanic rocks of the Umm Gheig Formation was formed in island arc environment.

CONCLUSIONS

The Umm Gheig Formation was formerly described as a new and unique metavolcanic formation belonging to the Abu Ziran Group of the Central Eastern Desert of Egypt [El-Anwar, 1983]. It constitutes a heterogeneous sequence of volcanic flows and tuffs together with subordinate amounts of tuffaceous sediments.

Based on the petrography, structure setting and regional metamorphism, the Umm Gheig Formation was subdivided into two distinct associations namely the Wizr greenschist association and the Kab Ahmed epidote-amphibolite association.

Interpretation of chemical data of different rock types included in both associations of the Umm Gheig Formation revealed the following conclusions:

1) Rocks of the Umm Gheig Formation were originally derived from basalt, andesite, quartz andesite with subordinate rhyolite (the latter is restricted to the Kab Ahmed epidote-amphibolite association).

2) Variation diagrams between major oxides and differentiation indices indicate a close consanguineous magmatic relationship of both associations of the Umm Gheig Formation including the amphibolite rock varieties.

3) Variation diagrams of alkali-silica, $FeO^*/MgO+FeO^*$ *versus* FeO^*, SiO_2 and TiO_2 as well as AFM diagram indicate that these rocks are likely to be originated as a product of tholeiitic magma type.

4) Rocks of the Umm Gheig Formation are clustered within the field composition belonging to the Umm Seleimat Formation, the Sukkari Formation, the Muweilih Formation and part of the Eraddi Formation on AFM and $FeO—Fe_2O_3—TiO_2$ diagrams which were used for separation different metavolcanic rocks of the Central Eastern Desert of Egypt.

5) Plotting the data with the newly published diagrams discriminating different tectonic settings, particularly volcanic rocks occur in orogenic belt similar to the present rocks, it is highly favoured that the Umm Gheig Formation implicated in island arc past tectonic environment.

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