The First Report of Fungal Fruit Body from North of Iran "Gorgan,s Schists"

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Abstract: In most parts of the low grade metamorphic rocks or complex is called "Gorgan's Schists" by Gansser, 1951. Much Fungal spores and fruit body could be found in this rock unit. This kind of palynomorphs can be obtained from low grade sedimentary metamorphic rocks such as Slate, Phylite, Calcphylite and Calcschist. Along with the processing of 250 samples the author have encountered with Fungal fruit body that are accompany by fungal spores, Angiosperms pollen, Gymnosperms pollen, and Pteridophytes. All the mentioned palynomorphs are close resemble with Tertiary Palynomorphs which are reported from rest of the world. In this investigation the author have obtained Fungal fruit body less than the other kinds of Tertiary Palynomorphs that are presented in this paper. According to frequency of Tertiary Palynomorphs in G-organ's low grade metamorphic rocks can ascribe most parts of this complex to Tertiary geological time. Previous studies have assigned this rock unit to Precamberian, upper Devonian, upper Paleozoic and Preliassic. A few reworked palynomorphs have obtained by sample processing that help the complex and mixing event such as Olistostorome theory. Because of mixing and metamorphism cannot indentify a boizone in this rock unit.
[Salman velayati. **The First Report of Fungal Fruit Body from North of Iran "Gorgan,s Schists".** *J Am Sci* 2013;9(10s):36-43]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 6

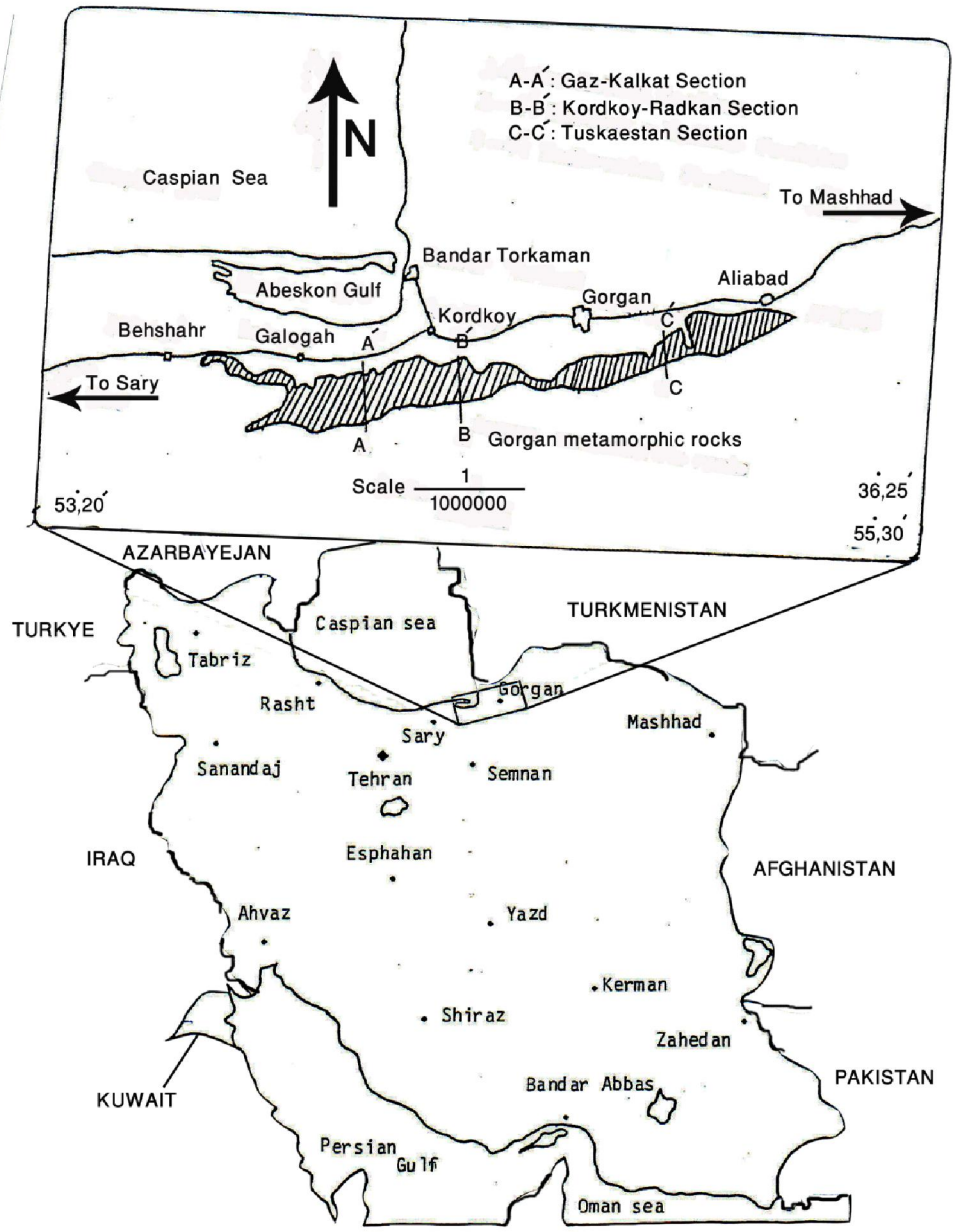
Key words: Gorgan's Schists, Olistostorome, Tertiary, Palynomorph, ngiosperm, Gymnosperm, Fungal spore, Fungal fruit body

Introduction

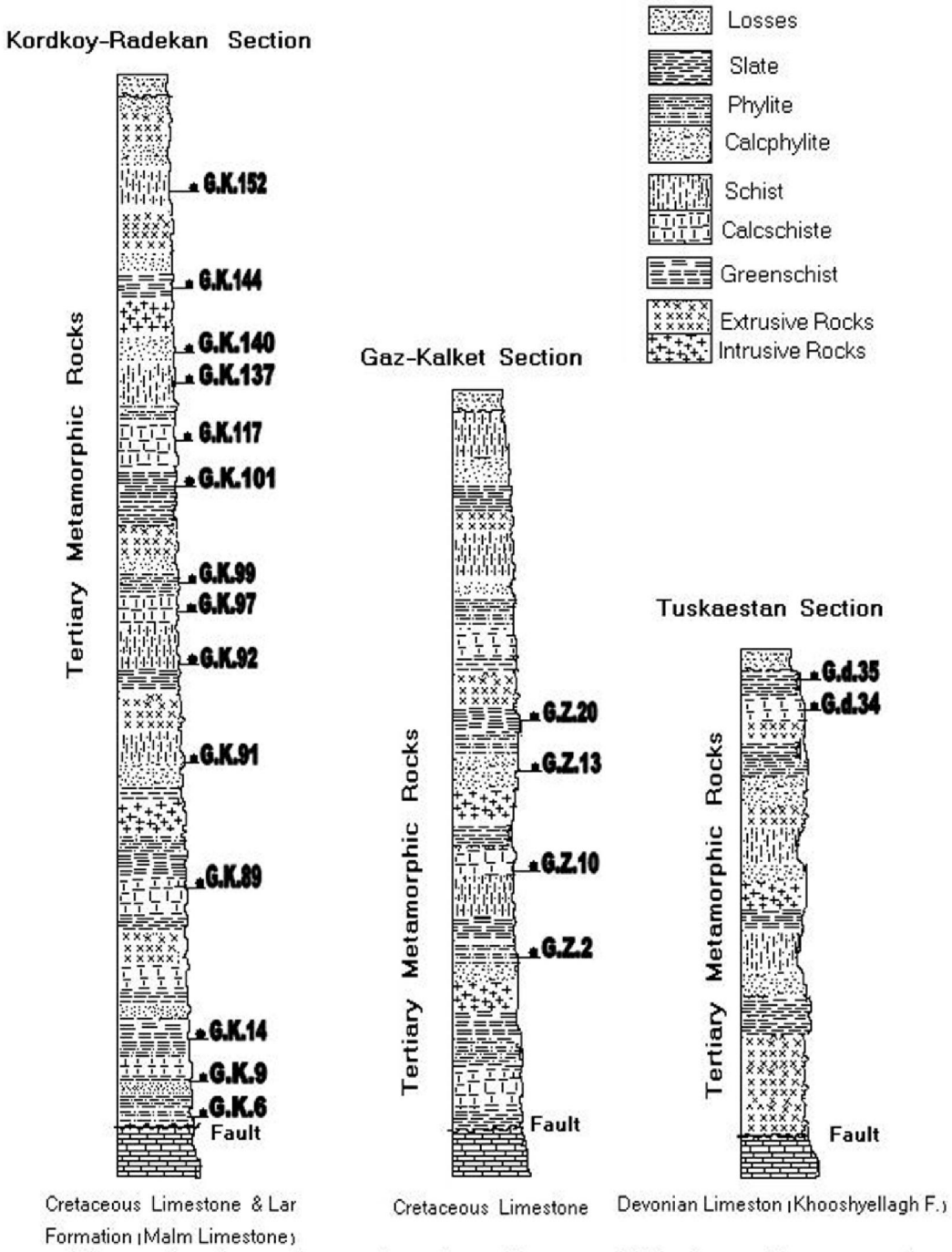
The Gorgan's Schists or metamorphic coplex is lied from east of Behshahr to west of Aliabad city in north-northeast of Iran (fig 1). It is extended 110 km in length and 15K maximum width Gorgan's metamorphic cmplex comprise Slate, phylite, Calcphylite Schist and Calcschist, along with metagabbro, metadiorite, metatrachyte, metaandsite, metatrachy-andsite and metatuff. Metaextrusive and metaintrasive rocks are in mass formed and not continuous, so they are sorrunded by sedimentary metamorphic rocks. Gansser, 1951has assigned Devonian geological age for this complex. StÖcklin,1955 has ascribed this complex to Precambrian, then on the basis of Hubber,1957 investigation this complex belongs to Silurian-Devonian. Berberian and his colleague,1973 have suggested that this complex probably are formed in tow different geological times (Devonian and preliassic). On the basis of Jenny's, 1997 opinion the facies of this complex is less than green schist or near to Prehenit-Pompilite facies and has the age of Precambrian.

Green schist facies has been proposed by Salehi-Rad, 1979 on the base of low grade metamorphisem, and Precambrian geological time. In 1988 Hoshmand-Zade et al, 1997 has planed a volcanopiroclastic environment with slowly subsidence for this complex and have refused the all previous age determination through rad iometric method. Ghasemi, 1990 has proposed a thrust fault contact between Lar formation (Malm limeston) and Cretaceous limestone with Gorgan's lowgrade metamorphic rocks. Kangi, 1994 has also identified a thrust fault contact between Lar formation (Malm limestone) and cretaceous limestone with Gorgan's low degree meta morphic complex.

Ghavidel, M, 1994 by three spot samples in palynological investigation has recognized some Acritarch, Scelocodont and Chitinozoa, so that he has proposed upper Paleozoic geological age for this rock unit. Differentiated geological ages for this complex have happened by mixing and non continuous trend of sedimentary layer and effect of tectonic phases, most reworked pebbles and blocks from earlier formations with different sizes (microscopic up to 500 meters) and geological age transferred from high lands to sedimentary environment during Tertiary epoch. A low grade tectono metamorphism affected on this complex and sheared it. Well preserved alynomorphs could endure low temperature and presser tectonic event so they are suitable for palynological studies.From low grade sedimentary metamor phic rocks visa Slate, Phylite, Calcphylite and Calcschist valid palynomorphs are avaliable and useful for identification and de - termination. For mixing and complexing it is not possible to identify the earlier layers in this complex and cannot pre sent a palynoassemblage palynobizone and orrelation.



(figure 1) **Geographic location of studied area**



(figure 2) Schematic stratigraphy column and lithology of cross Section with location of productive samples Scale: 1/10000

Method and Materials

Altogether 250 samples were collected Slate, Phylite, Calcschist and Calcphylite, along the road side section. To avoid of contamination the samples localities were digged 30-40 cm and the no weathered samples kept in polythene bags, labeled and sealed. The samples were washed and carshed carefully and treated with HNo3 for5-10 hours, Hf 70% for 24 hours and Hcl 17% for 24 hours.

The samples were rinsed to neutralization between each step. The residue after sieving with250µ sieve, boiled with Hcl for half an hours, at last the residue centrifuged with Zncl2 and passed through sieve 20µ. Finally residue mixed with P.V.A. and on the low temperature heater dried or desiccated, then lameled with liquid Canda Balzam.

Geology

The complex of low grade metamorphic rocks in Gorgan's area, consist of low grade sedimentary metamorphic rocks including Slate, Phylite, Calcphylite, Calcshist, and Schist. There are low grade igneous metamorphic rocks visa metagabbro, metadiorite, metatrachyt, metatrachy-andsite and metatuff, among the above mentioned sedimentary rocks. These igneous rocks are found separated, discontinuous and mass like. All earlier formations that laid close to metamorphic rocks unit doesn't contain any metamorphic pebbles and blocks. There is no any evidence of metamorphic pebbles in the base of Koshyelagh formation that is sandstone and quartzite, and also in the base of Shemshak formation which are siltstone and marl, Lar formation (limestone) there are merely pieces metamorphic rocks in the base of Cretaceous limestone (Campanian-Maistrichtian). But there are no enough informations about the cause of metamorphic pieces in the base of Cretaceous limestone. There are some hesitation if these pieces are thrust fault blocks or basic conglomerate, because they are mostly in angular forms. In three geological cross sections 250 samples were collected from metamorphic rock that a few of them contains of Fungal fruit body. The location of these samples are displayed in schematic stratigraphic column (fig 2). In this schematic stratigraphic column all earlier formations have a thrust or unconformity contact.

Palynology

All palynomorphs have been obtained from low grade sedimentary metamorphic rocks, on the basis of comparing them with the other Tertiary (upper Palaeocene - upper Miocene) palynomorphs which are reported from rest of the world, they quite resemble with all Tertiary palynomorphs. The low degree of metamorphism that is confirmed with previous researches is close to low level green Schist facies (Prehenit-Pu-mpilte).

This condition has been caused the palynomorphs remain with a well preservation which are easily identified. Well preserved palynomorphs could be studied clearly from Slate, Phylite, Calcphyylite, Calcschists and Schists not much according to the Traverse's A., 1988 opinion (page 34).

Some Angiosperms pollen, Gymnosperms pollen, Petridophytes spore and Fungal spores were found in this investigation, that confirms the most parts of Gorgan's metamorphic complex are formed during Tertiary epoch. In this paper a few fungal fruit body are presented.

Systematic

Class *Ascomycetae*
Order *Hemisphaeriales*
Family *Microthraceous*
Genus *Kutchiathyrites* Kar, 1979
***Kutchiathyrites eccentricus* Kar, 1979 plate: 1 figs: 1,2,3**

Description

Fungal fruit body, ascomata, bugle to fan form in out line, surrounding area psilet and no indentation at peripheral area, cells are formed by interconnected hyphae and are larger from center up to margin. Squarish cells that are rectangular near margin. main hyphae in radiation form show a pseudoparnchym issue. Size 100×78µ.

Distribution

This species is reported from Tertiary northwest of India (Kar, 1985), Miocene of northeast India (Kar, 1990), Eocene of west India (Kar & Bhatacharya, 1992), Eocene of India (Saxena & Sanji, 1992).

Affinity

Microthyriacea

Remark

This species is slightly larger than that spcies is reported from Tertiary of India (Kar1979).

Occurrence

Gorgan's metamorphic complex, Tuskaestan and Kardkuy geological section, samples G.D.34,35-G.K.92.

Genus: *Phragmothyrites* Edwards, 1992
Type species:*Phragmothyrites eocaenica*
Edwards, 1992
***Phragmothyrites eocaenica* Edwards,1992**
Plate 1 fig,6

Description

Fungal fruit body, lack of ostiol in central area, surrounding area psilet and no ornaentation flatted, circular to sub circular in outline, hyphae prominent, interconnected hyphae are made cells and pseudoparanch-ym issue,central cells have thicker walls so with a black corona reflex. Size 100µ

Distribution

This species is reported from Scotland in Eeocene (Edwards, 1922), Tertiary west of India (Jain & Gupta, 1970), Paleocene of India (Venkatachala & Rawat, 1972),Miocene of India (Singh & sarkar, 1984), Tertiary north west of India (Kar, 1985), Miocene northeast of dia (Kar, 1990), lower Miocene of India(Singh & Sarkar, 1994), Tertiary Europe and angal (Chandra & Kumar, 1997). Oligocene & Lower Miocene of India, Assam (Singh & Saxen&Rao,1986)

Affinity

Microthyriacea

Occurrence

Gorgan's metamorphic complex: Kordkuy Radekan section samples GK.6, 91, 101,152.

Family: *Microthyriaceae* Saccardo 1883
Genus*: Callimothallus* Dilcher 1965
Type species*: Callimothallus pertusus* Dilcher 1965
***Callimothallus pertusus* Dilcher 1965**
Plate 1 Figs 4,5

This species is reported from Oligocene of Guangxi, south of China by Gongle s. & Zhiyan z. & Zhiming x. (2010)

Callimothallus pertusus Dilcher 1965

Is assigned as a cuticle of Canninghamia praelanceolta sp. nov. reported by Bao – Xia – Du et al from upper Miocene of eastern Zhejiang, S.E China(2012)

Genus: *Paramicrothallites* Jain & Gupta 1970
Type species: *Paramicrothallites spinulatus*
Paramicrothallites sp.
Plate 2 fig 2

Description

Fungul fruit body flatted, circular, no ornamentation at laterals ends and psilet at surrounding area, hyphae find and not clear with radiation arrangement, ostiol at the center and di- stinct, surrounded by no special cells so is has not thicker walls. Weak interconnection thin hyphae have made fine cells quadrish at central area gradually rectangular at lateral margin.Ostiol 8-10µ, size100-120µ.

Affinity

Microthyriacea

Remark

This species is different with size and shape from Paramicrothalites menonii(Jain & Gu-pta, 1970) that reported from Tertiary of w-est India.

Occurrence

Gorgan's metamorphic complex. Kordkuy-Radekan section sample G.K.92.

Genus: *Actinopelet* Saccardo, 1913
Type species *Actinipelet sp.*
Plate 2 fig 1

Description

Fungal fruit body, flatted, circular, to sub-circular appendage at margin bar shape, ostiol distinct at central area, surrounded by thick walls cells, hyphae radiated and distinct. Interconnection of hyphae have made cells and pseudoparanchym central cells quadrish to circular and by the thick walls a thick corona is mad near the ostiole, lateral cells are rectangular with fine walls. Dime-nsion of ostible 5-6µ, size 117µ.

Affinity

Microthyriacea

Remark

This species in complete different with Actinopelet (Elsik, 1974), that reported from Eocene of north America is different by distinct ostiol and clean marginal appendage

Occurrence

Gorgan's metamorphic complex: Kordkuy Radekan section samples G.K.89, 117

Genus: *Phragmothyrites* Edward,1922 Type species:*Phergmathyrites eocaenicus* Edward,1922
***Phragmothyrites concentricus* Phipps et Rember 2004**
Plate 2 figs 3,4

The exact identification and diagnosis of Phragmothyrites conccentricus is in the page 69 of article (Epiphyllous fungi from the Miocene of Carkia, Idaho) Phipps C. J. & Rember W.C. 2004.average size around 40x38µ.

Occurance

Gorgans metamorphic complex:Tuskaestan& Gaz-Kalkat sections samples G.D.35,G.Z.20

Genus: *Microthallites* Dilcher, 1965
Type species: *Microthalites lutosus* Dilcher,1965
Microthallites sp.
Plat 1 figs 5,6

Description

Fungal fruit body. Circular to sub- circular, central area distinct with 4-6 dense cells.

The cells around ostiol with a thicker walls. Hypha radiated and interconnection of hyphae have made cells and pseudoparanchym issue. Thick hyphae at the marginal area are rare.

Quadrish cells are at the central and marginal area, central cells are smaller and thicker than marginal cells. Size 38-42×33-38µ

Affinity
Microthyriacea

Remark
This species has a central nuclear or pse-udostiole and larger cells from Microthal-ites that reported by (Edward, 1992).

Occurence
Gorgan's metamorphic complex: Kordkuy
Radekan section samples G.K.91,1 37, 144
Gaz-Kalkat sample G.Z.2

Genus: *Trichothyrites* Rosendahl, 1943
Type species: *Trichothyrites pleistocenica*
Trichothyrites hordlensis Smit, 1984
Plate 3 figs1,2

Description
Fungal fruit body, discoid to flat form, marginal area crooked, hyphae radiated and interconnection of hyphaes have made cells. Dimension of cells 3-8µ, cells arun-d ostiole are dense by 2-3 rows with less than 2µ in size and have made a 15-20µ corona around ostiole. Diameter of ostiol-e. 10-15µ size 75-80µ

Distribution
Lower Tertiary of England (Smit, 1980)

Affinity
Microthyriacea-Ascomata

Occurrence
Gorgan's metamorphic complex: Kordkuy
Radekan section, samples G.K. 14, 97, 99 101,140.

Genus: *Notothyrites Cookson, 1947*
Type species:*Notothyrites Padappakarensis* Jain & Gupta, 1970
***Notothyrites padappakarensis* Jane &Gupta, 1970**
Plate 3 figs 3,4

Description

Fungal fruit body, flatted, circular to sub circular, distinct ostiol in center, hyphae radiated distinct and clear, interconnection of hyphaes have made cells, size of cells 2-4µ, to marginal area cells are elongate and larger. Thicker wall cells around ostiol in 2-4 rows have made a corona, diameter of ostiol 7-10µ. size 110µ.

Distribution
This species is reported from west of India and Assam (Jain & Gupta, 1970),(Singh & Saxena & Rao,1986) and Bangladesh (Saha, 1990) and from Tertiary.

Affinity
Ascomata, Microthyriacea.

Occurrence
Gorgan's metamorphic complex, Kordkuy
Radekan geological section, samples G.K
6, 92, Gaz-Kalkat section, samples G.K.9, 14

Genus: *Notothrites* cookson,1947
Type species:*Notothyrites padappakarensis* Gain & Gupta,1970
***Notothyrites setiferus* cookson**
Plate 3 figs 5,6

Fungal fruit body discoidal to circular in shape, without denticular or ornamentation at margin. Hypha interaction are made cells. Central cells are smaller than marginal ones, medium size of cells.05x.03µ. Radial hypa are more thicker than circular hypha and visible. Ostiol is very obvious, about 1-2µ in size with a 1µ thickening margin which surrounded it. Size about 80µ to 100µ.

Distribution
This species is reported from Tertiary of Kachchh in India (Kar, 1985) and Tertiary of Bangladesh (Saha, 1999) from Oligocene & lower Miocene of Meghalaya and Assam in India (Singh H.P. & Saxcena R.K. & Rao M.R, 1986).
Finally from Mio-Pliocene of India (Kar R.K.,1990)

Affinity
Ascomata, microthyricea

Occurance
Gorgans metamorphic complex. Tuskaestan and Gaz-Kalkat geological sections, samples G.D.34,G.Z.10

Plate: 1
1-3-*Kutchiathyrites eccentricus* x 500 Kar 1979, slide no G.K.92, G.D.34
4-5-Callimothallus pertusus x 1000 Dilcher 1965, slide no G.K.152, G.K.43
6-Phragmothyrites eocaenica x 500 Edwards 1992, slide no G.K.92

Plate: 2
1- *Actinipelet sp.* x 500 slide no G.K.89
2- *Paramicrothallites* sp. x 1000 slide no G.Z.20
3-4- *Phragmothyrites concentricus*. Phipps et Rember 2004, x 1000 slide no G.K.91,G.K.136
5-6- *Microthallites sp.* x1000 slide no G.Z.2

Plate: 3
1-2- *Trichothyrites hordlensis x 500 Smit 1984, slide no G.K.99.*

Conclusion

The presence of Tertiary palynomorphs (upper most Paleocene-upper most Mioce-ne) in Gorgan's low grade metamorphic rocks. Indicates that during the Tertiary era there was a vast sedimentary environment on the bank of mountains. There have been older formation on the high lands. In this region, warm and humid land plants were spread similar to today's Mazandaran situation. Some exotic pebble and blocks are reworked from earlier formations to the Tertiary sedimentary environment.

So that you can find reworked Paleozoic palynomorphs in this rock unit. In this w-ay it could be imagined a sedimentary en-vironment with numerous exoticblocks an-d pebbles that were reworked from earlier formations through Tertiary epoch. Thay have been affected by tectonic effections and sheared and metamorphsed in the u-pper most Miocene. The presence of fun-gal fruit body and spores indicate a warm and humid sedimentary environment. The other index Tertiary palynomorphs are fix reasons for this complex which has been formed in Tertiary geological time.

Acknowledgement

I appreciate professor Rao, M.R.and professor Jolley, D. for their advising about Tertiary palynology when I was taking a long course in B.S.I.P (India) and sheffield university (England). I am thankfull to Dr Shahida,M. professor Kavari, E. for their advising and appreciate to my assistant Nikkholg, M. for his helping on processing and providing some slides.

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9/26/2013