

## **paleoenvironment Analysis of Abderaz Formation in Kopet Dag Basin**

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### **Abstract**

*Kopet – Dagh sedimentary basin is located in the east-northern Iran. Abderaz Formation is one of upper cretaceous units which is Late turonian –Early santonian in age.three palynofacies in this formation were distinguished .Also,presence of environmental index dinoflagellates like Klithrosphairidium, Oligosphairidium ,Spiniferites,assigns the sedimentary environment of this formation to shallow- coastal open marine.ratio of light SOM to dark SOM also indicates predominant low oxygen conditions govering on the sedimentary environment of abderaz formation.*

### **Discussion**

Kopet-Dagh sedimentary basin is one of tectonic structural units in east north part of Iran in which thick marine and detrital sediments were being deposited Jurassic through Oligocene. Kopet-Dagh successions are the perfectest and thickest cretaceous deposits in Iran. Transgression and regression of the sea in cretaceous were repeated due to tectonic movements (orogeny and epeirogeny) and sedimentation in this area was not continuous. Abderaz Formation is one of sedimentary units of Kopet –Dagh basin of upper cretaceous age whose name has been adapted from Abderaz village which is situated on the east part of Kopet-Dagh in north-west of mozdoran vilage. The mentioned section is placed near Hamam-Qaleh vilage and is 25 kilometers far from Kalat Naderi city. . Abderaz Formation in this section is 607 meter thick from which 44 samples were collected. The lithology of this formation includes mainly bluish gray shales,gray marl shales and calcareous shales and four chalky limestone bands. in order to determining the sedimentary environment are as follows:

#### **1) Allochthonous elements**

Including maceral types. Maceral sizes,colors,frequency and their preservation state is important to determine the palaeoenvironment. If maceral are blade, they show more buoyancy . if macerals are larger,this means there has been less transportation and these elements were reworked from outside of the basin to inside of it and they include following types:

A-Palynomaceral type 1: dark brown orange organic matter with structure or without it.

B-Palynomaceral type 2: brown orange organic matter with regular shapes.

C-Palynomaceral type 3: pale organic matter which is pale in color and somewhat thin and irregular with primary structure.

D-Palynomaceral type 4: black or somewhat black equihedral elements which the blade from has buoyancy characteristics and travels long distances.

#### **2)Autochthonous elements**

Including dinoflagellates,acritarchs,marine green algae,microforaminifer test lining, and structureless organic matter (SOM).

300 palynomorphic elements such as types of dinoflagellate ,palynomacerals and SOM has been counted by chance in palynological studies of Abderaz formation and result of it is

distinguishing and verifying three palynofacies. (Tyson, R.V.; 1993 Van Der Zwan, C.J.; 1990 )

Palynofacies I in which SOM are low and 0-30 % which are mainly light in color. palynomacerals are 10-35 % and marine palynomorphs are 40-70 %. Samples 26-28-29-37 are placed in this palynofacies. This palynofacies indicate an open marine environment (Fig 1). Palynofacies II in which palynomacerals are 20-50 % and SOM are 20-30 % and marine palynomorphs are 10-35 % . this palynofacies is placed in open marine environment which is shallower more than palynofacies I. palynofacies III in which marine palynomorphs are 0-10 %, palynomacerals are 20-80 % and SOM are 20-30 % which are mainly light in color. This palynofacies indicate a decrease in depth of the basin environment.

Dinoflagellates are palynomorphs which play a basic and useful role in determining the basin environment. Study of the palynological slides of Abderaz Formation shows that dinoflagellates are the most abundant palynological elements in the slides. From this point of view, 52 genus and 85 species of dinoflagellates was recognized. Index dinoflagellates are one of the most important factors in paleosedimentary environment analysis (Suijls, A., Pross, J.; Brinkhuis, H.; 2005). which chorate and cavate forms are more frequent and proximates and proximochorates are less frequent. When the environment is suitable for reproduction and nourishment accompanied by transgression, dinoflagellate frequency and diversity rises. The genus *Spiniferites* with various species *Surculsphaeridium*, *Oligosphaeridium*, *Cymosphaeridium*, *Tanyosphaeridium* and *Florentina* occurs on samples 25-26-28-29-37. The number of chorate forms increased dramatically in comparison with cavate forms in some samples which attributes to increasing of the basin depth. The taxonomic dinocyst diversity decreased in samples 27-31-36 and some kinds of the genus *Dinogymnium*, *Glaphyrocysta*, *Palaeoperidinium*, *Spinidinium*, *Apteodinium* and indicate a restricted and more shallow marine environment. The increasing of cavate form in comparison with chorate forms also is an indication of becoming more shallow and restricted environment. Presence of spiniferites in association with high amounts of palynomacerals evidence of being shallow and regression of the sea and the dinoflagellate frequency and diversity is very low or zero in samples 41-42-43-44.

Other factors determining the type of palaeoenvironment is the Lability factor. This factor is the ratio of brown macerals to opaque macerals. The brown macerals are of terrestrial plants and indicate near coast environment. (Schioler, P.; Crampton, J.S.; Laird, M.G.; 2002). Opaque macerals are dark in color which indicate an environment of half oxic and usually increase in offshore environment. This factor varies throughout Abderaz formation. The increase of this factor is evidence of shallowing of the basin where the palynomorph number is decreasing in palynofacies III. (Lability diagram)

The increase of this factor in samples 2-6-8-18 in association with high preservation of organic matter. Light SOM to dark SOM ratio is another environmental factor. (light SOM to dark SOM diagram). Light SOM is created in an environment of low oxygen a little below the sedimentation level by action of anaerobic bacteria. Transparent SOM is caused by lack of oxygen and low sedimentation rhythm conditions (Fig2). (Zonneveld, K.; Versteegh, G.; Lange, G.; 1997). Anaerobic bacteria hydrolyze organic matter by using the oxygen dissolved in water and dark SOM is being created. If light SOM to dark SOM ratio is more than 1, it shows conditions of low oxygen and how much this ratio is less than 1, this indicates oxic

conditions. (Bombardiere, L.; Gorin, G.E.; 2000, Waveren, I.; Visscher, H.; 1994) Studies and calculating of this factor in samples of this formation is more than 1 which indicates low oxygen conditions governing the sedimentary environment during accumulating of sediments in Abderaz formation. This ratio in samples 7-8-9-13-21 is less than 1. presence of few amounts of dinocysts in these samples in association with high amounts of dark SOM shows that oxic conditions predominated the environment but these conditions were not stable.

### Conclusions

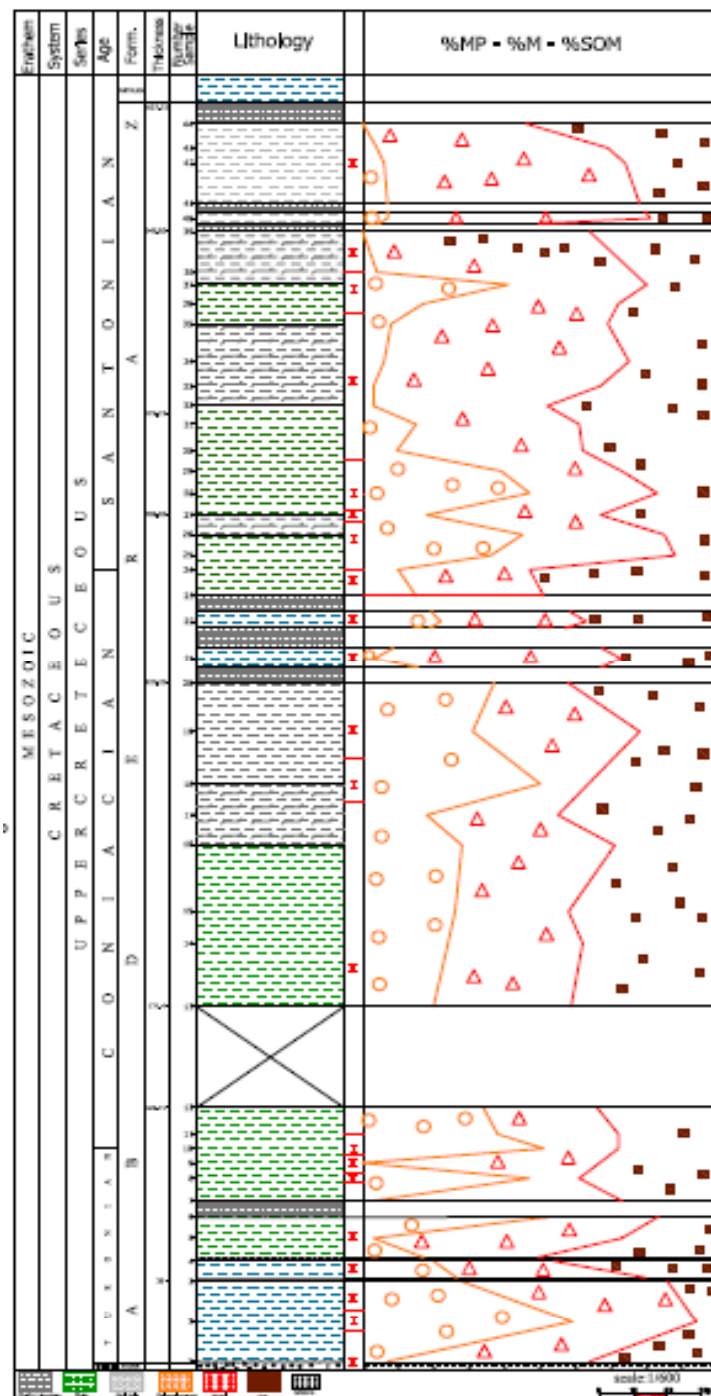
Three palynofacies were distinguished in Abderaz formation on the basis of palynological studies. palynofacies I, II, III which correspond to open marine environment, more shallow open marine environment and shallow coastal environment respectively the sedimentary environment of this formation is open marine to shallow coastal environment on the basis of index dinoflagellates.

the factor of light SOM to dark SOM ratio indicates a predominant low oxygen environment for this formation.

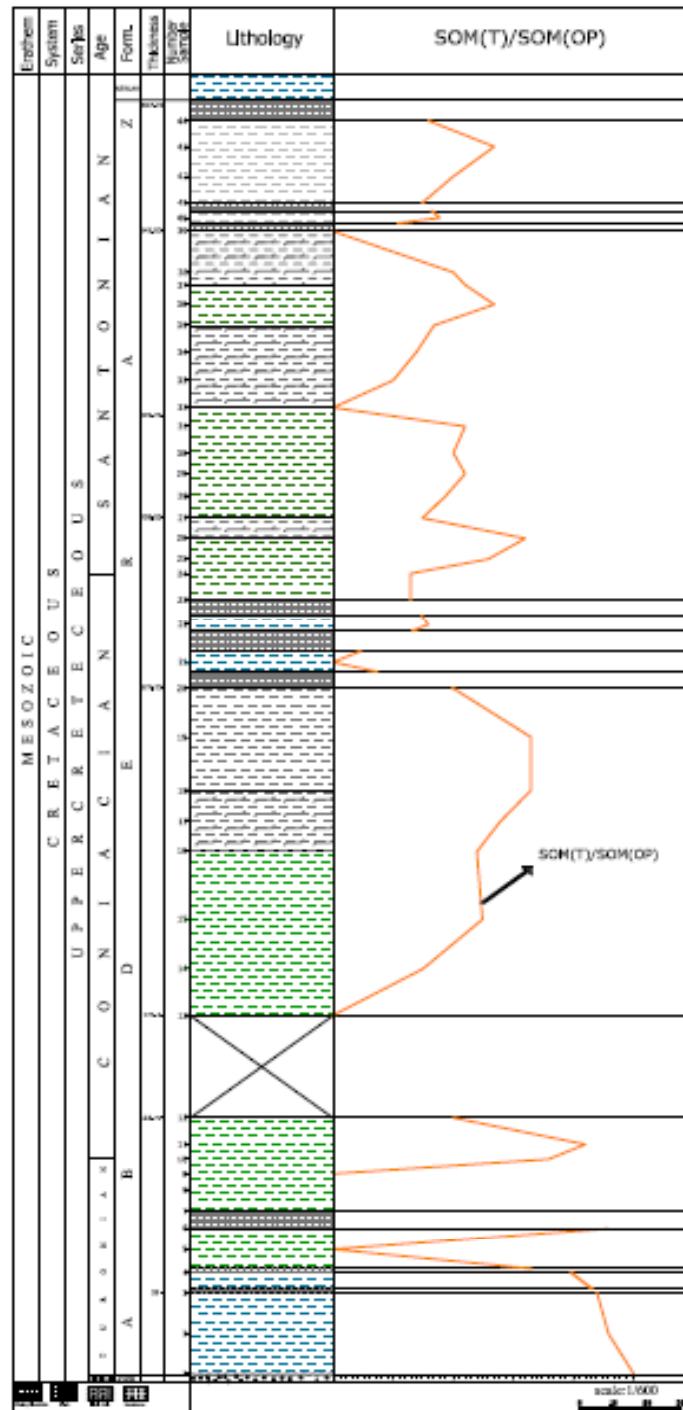
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1-Palynofacies diagram



2-Light SOM to dark SOM diagram