The study of the umbilical system in planktonic foraminifera in relation with depth of the Abderaz Formation at type section, IRAN

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Abstract

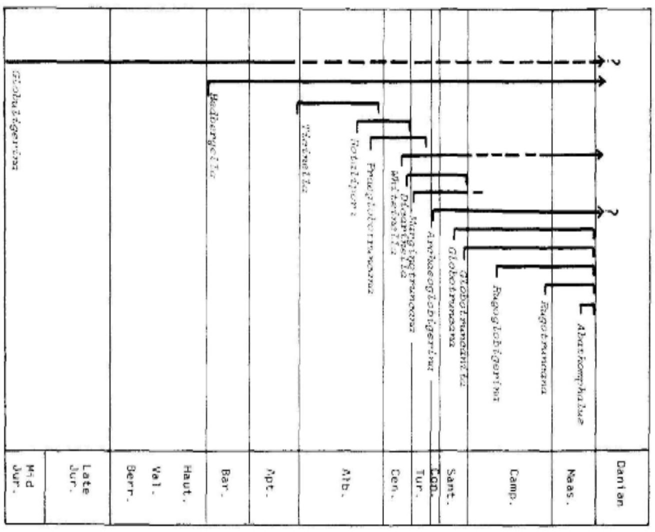
Prospect of changes in such umbilical structures as Lip, Portici and Tegilla throughout Turonian-Campanian was also investigated. The phylogenic trend show that Lip structure in primary morphogroups turns gradually to tegilla in more developed forms in which the opening become also entirely umbilical. Statistical an analysis showed that the trends of changes are correlatable with increase in water depth while a decrease in depth result in development of lip in the planktonic foraminifera studied. The changes are considered to be in accord with Pascal law.

Key words: Abderaz Formation, planktonic foraminifera, Pascal law, Evolution, Lip, Portici, Tegilla

Introduction

The fact that is obvious in the evolution trend of planktonic foraminifers in (Hedbrgellids) From Early cretaceous to Gobotruncanids in the late cretaceous is that their evolution from the outset shapes to advanced, this unicellular have a completely umbilicus part With a cover plate named tegilla (Loeblich and Tappan, 1950). The main aim of the study is to know if the created trends of changing in shell of these animals made by the depth changing of the existence time of the animal shell because that is proved, *Hedbergella* was in shallow depth and the shapes of their evolution had lived in more depth water comparing to their ancestors (Fig1). And SEM images were taken from them by using VEGA TESCAN (plate1).

Fig1: Depiction of planktonic foraminifer's evolution (Caron and Homewood, 1983)



Geography and study area

Type section of Abderaz Formation has 300m thickness (E: 60, °33′, 00″, N: 36°, 10′, 40″) NE Mashhad (a city of Iran), is located in Mashhad-Sarakhs road far about 1 km to the Muzduran (fig2).

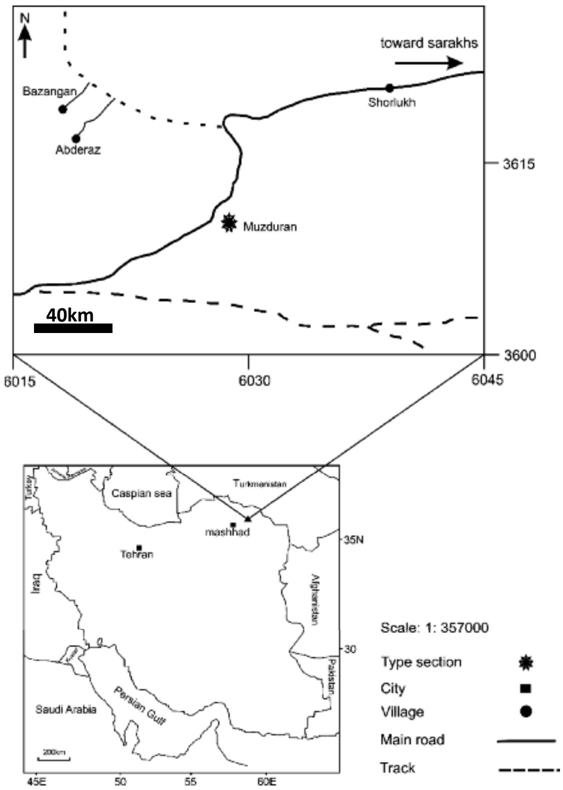


Fig2. The geographical map and the ways to the region of the study.

Stratigraphy of the above- mentioned region

Abderaz Formation is one of the upper cretaceous formations in north- Eastern of Iran. This formation at the typical gap has 300 meters thickness and contains 11 lithological units.At the typical gap such as all regions under the surface sub-contact of Abderaz Formation are un-correlated with Aitamir Formation. But its upper layer with Abtalkh Formation is in continuous correlation. The upper layer has elected as chalk limestone upper border. planktonic foraminifera are exist in the chalk limestone boundary of this formation with the most and less diversity.

Method

One hundred thirty samples were gathered in from the typical gap of Abderaz Formation with 300m thickness. Only 102 samples were included in study, 7 samples due to the existence of salvation effects and 21 samples was obtained from reworking damages that were excluded from the study. Hence at the demonstrated stratigraphic column from the above- mentioned region , the reported size of the samples was about 2.94m. Depending on the kind of lithology the samples are washed in two methods:

1- Shale and marls samples:

after changing These samples to small pieces we have to put them in the H_2O_2 10% daily, then wash them by water on the screeners assigned with meshes125 and 63µm (Zepeda 1998).

2- Chalk limestone samples:

In this case the samples were also grid and were boiled in the Na_2So_4 solution and then washed with water on the screeners assigned with the above mentioned meshes (Peryt and Lamolda 2002).

Result

Groups of planktonic morphotyes are distinguished by depth of living (Hart, 1980a, Hart, 1980b, Wonders 1980, Keller, 1999) (Fig3). Those are consisting of:

1- Shallow area faunas

Heterohelix and *Hedbergella* and a big part of *Hedbergella* small samples like Globotruncanids genus are related to faunas of shallow epicontinental seas or the border sea (Eicher, 1969, Eicher and Worstell, 1970, Sliter 1972).

2- Middle water faunas

Praeglobotruncana and *Whiteinella* are related to these faunas.

3- Deep water faunas (lower than 100)

These faunas were counted like keeled shapes

there were 300 samples in the size of 120 mesh completely by chance, from every samples were counted that the result of this count shows at the first of successions and the time middle Turonian morphotype group one was conquering and the amount of the morphotype group three was les in the area that this paragraph. Shows the low level of water in area in this time and it is simultaneous with this down calculation time on the umbilical foraminifers structure, and it shows the majority of lip structures an vast orifice without umbilical situation. in the late Turonian the group of morphotype three was increasing in the area that it indicated the proportional increasing of depth in the area and by this time portici structure has been larger and in umbilical structure is born in this unicellular, and in Coniacian time has decreased the amount of morphotype three in the area again and the members of morphotype group one increased with the lip structure in the area again and during Coniacian to Santonian the members of morphotype group 3(M3) with association of tegilla shapes increase in the area for another time and in Santonian time, sea water shows a vacillation mood in the above-mentioned section (Fig4).

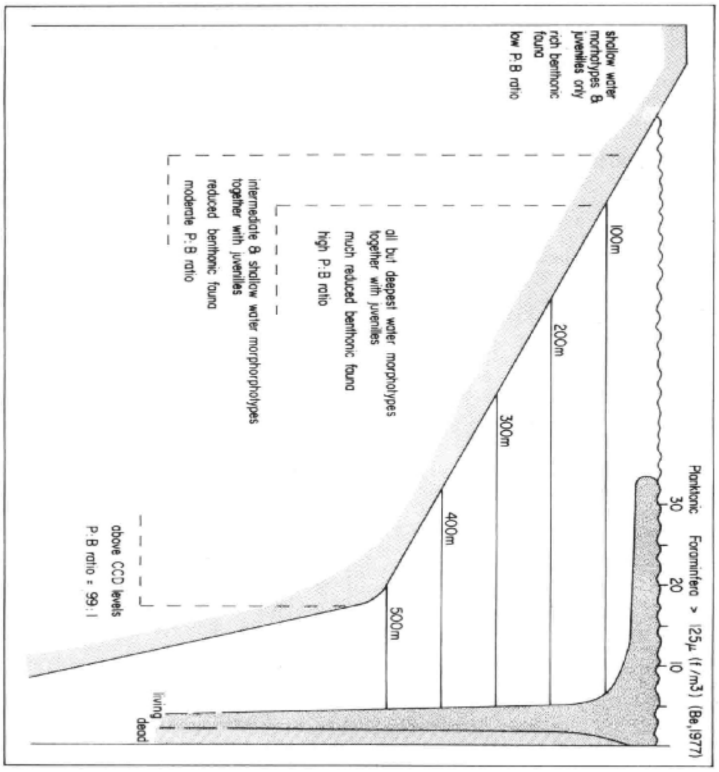


Fig3. Depth water Model variation (Hart, 1980a,b)

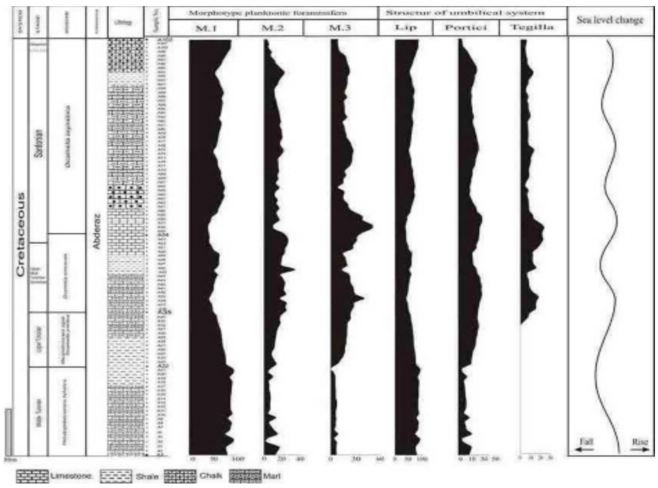


Fig4: Comparison of planktonic morphotype curves with structural umbilical system (M1= Morphotype group1, M2= Morphotype group2, M3= Morphotype group3)

One of the main aim of this paper is that according to the evolution chart of caron (Caron and Homewood, 1983), the primary shapes was coming from Jurassic foraminifers evolution with a vast orifice that lead to the border of the sell that the orifices of this animals are covered by a partial structure called lip, and finally the evolution of these unicellular change to its ancestors and covered by a complete plate called tegilla. These animals live in more depths area compare to its ancestors and the conclusions indicate that the created structures in this unicellular helps with find it compatibility in this animals by the depth they have lived. it seems by swelling the water planktonic foraminifers have some created structure changes in there shells for compatibility with new depths that the alteration trend is like umbilical part of shell compacting with completing a covered plate of the umbilical part that is changed from lip structure to tegilla structure. This created trend leads to decreasing the surface to volume ratio in this unicellular and it causes that the new generation could live in depths that this trend is according to Pascal low and doesn't seem that the created alteration arise from changing nourishing or reproduction way(Fig5)(Fischer and Arthur,1977).

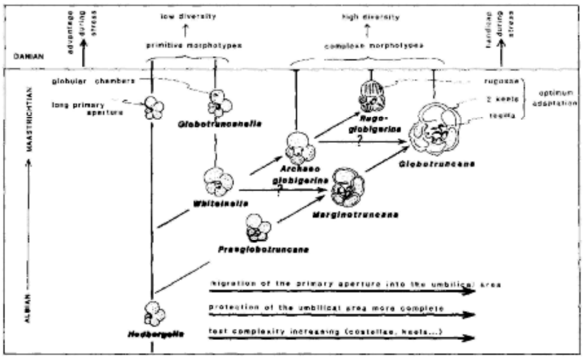


Fig5: Depiction of planktonic foraminifera umbilical system evolution manner in relationship with depth (Fischer and Arthur, 1977).

Discussion

in the time of middle Turonian simultaneous with subtraction of the percent of morphotype group three that indicates the dwindling of proportional in mentioned section. the structured shapes of lip increases but in the late Turonian that the percent of morphotype three increases that it would indicated the proportional of depth increasing in area and the structured shapes in vicinity has increased and the structured shaped (tegilla) recently has born and in Coniacian time the morphotype group three diminished again and lip shaped increase and in Coniacian - Santonian by increasing the shapes of morphotype three for another time (tegilla) and (portici) became more so that (tegilla) structure became the most in this time. that this affair it is because of the advent of *Globotrancana* and increasing the number of them in Santonian time but in the late Santonian and the early Campanian by diminishing the percent of morphotype three and increasing morphotype one , the lip shapes became more in area.

Base on this data we can recognize that by increasing the depth of lip structure it changes to a tegilla plate during million years that is unstable structure with one edge. by the continues of this trend the orifice will fine a completely umbilical situation in the end of its evolution that all the mentioned trend leads to decreasing the surface to volume ratio in foraminifers shell that according to Pascal law it can have a grate ability in living longer in more depths compare to their ancestors by the above- mentioned alters.

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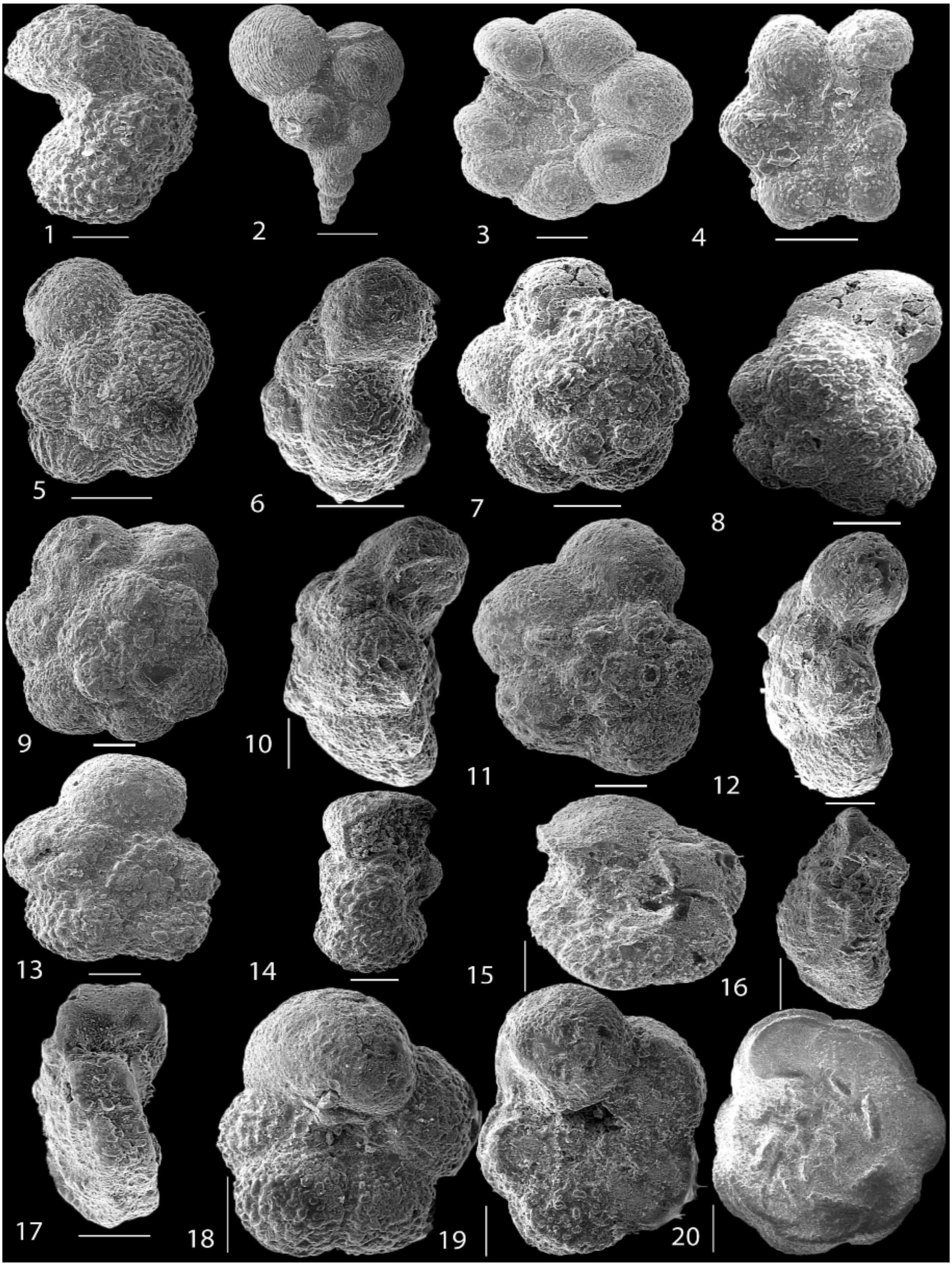

plate1: Morphotype 1 (1-4): 1; *Hedbergella delrioensis*, (Sample1). 2;*Heterohelix globulosa*, (Sample30). 3 ;*Globigerinelloides ultramicra* , (Sample12). 4; *Globigerinelloides alvarezi ,* (Sample54) . 5; *Rugoglobigerina rugosa*, (Sample70) . 6; *Whiteinella aumalensis* (Sample18) . 7-8; *Whiteinella paradubia*, (Sample30) . 9-10; *Praeglobotruncana stephani* (Sample26). 11-12; *Praeglobotruncana delrioensis*, (Sample16). 13-14; *Helvetoglobotruncana helvetica* (Sample7) .15-16; *Marginotruncana sigali*, (Sample12). 17; *Marginotruncana pseudolinneiana*, (Sample53). 18 ;(lip).umbilical view of *Hedbergella delrioensis*, (Sample1). 19 ;(portici). Umbilical view of *Dicarinella imbricata*, (Sample12). 20 ;(tegilla). Umbilical view of *Globotruncana arca*, (Sample53).all Samples have100µm scale bar.

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