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Microbiostratigraphy of the Tarbur Formation, Zagros Basin, Iran

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Abstract: The Tarbur Formation is a predominately carbonate lithostratigraphic unit that outcrops in Zagros basin, between main Zagros reverse fault and high Zagros and east of Sabzpushan faults. This Formation was studied from microbiostratigraphic point of view at four measured sections, in the north of Khorram Abad (Robat section) in the east of Khorram Abad (Chamsngar section) in the east of Shirz (Sarvestan section) and in the south east of Semirum (Balghar section). Microbiostratigraphical data mainly based on foraminifera which among them, species of *Loftusia* have more variety and abundance, so the species of *Loftusia* from the measured sections are used to determine the age of successions. It is analogous to *Omphalocyclus-Loftusia* assemblage zone but according to the distribution of the index species of *Loftusia* the age of Tarbur Formatoin is Early-Middle Maastrichtian at Sarvestan section and Middle Maastrichtian for Balgar, Robat and Chamsangar sections.

Key words: *Loftusia*, biostratigraphy, Maastrichtian, imbricated Zagros

INTRODUCTION

The Tarbur Formation is carbonate sediments that extends from southeastern to northwestern of Zagros basin along the western edge of the Imbricated Zagros zone and between Main Zagros reverse fault and High Zagros fault and east of Sabzpushan fault (Alavi, 2004). High Zagros fault consists of several part, north to south, Sephid Kuh, Zardkuh, Dena and Bakhtegan faults (Fig. 1). Southern outcrops of Tarbur Formation are between Sabzpushan and high Zagros fault. Facies and thickness contour maps controls and field investigation revealed that the Sabzpushan fault was frequently active from Middle Cretaceous (Cenomanian) to recent time (Safari, 2006). At Campanian-Maastrichtian, facies changed of Gurpi shale and marl, west of Sabzpushan fault, to Tarbur limestone, east of this fault (Ghazban, 2007).

This study relates to foraminifera from four stratigraphic sections (Fig. 1), 10 km north of Khorram Abad, Robut section, 30 km east of Khorram Abad, Chenar section, 18 km southwest of Semiroum Balgar section and 39 km southeast of Shiraz, Sarvestan section. During Late Cretaceous the Arabian plate was subjected to both compressional and extensional stresses (Sharland *et al*., 2001).

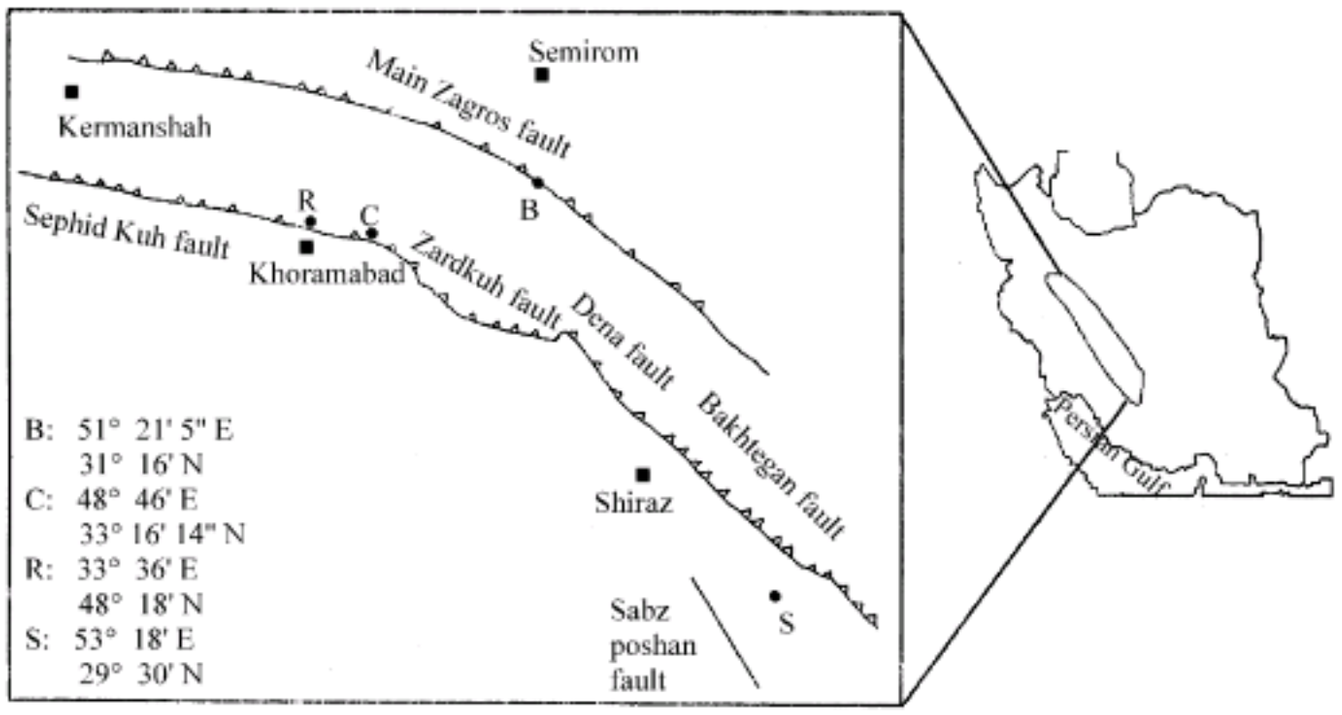

Fig. 1: Location map of sections referred to in text, B: Balghar section, C: Chamsangr section, S: Sarvestan section, R: Robat section (without scale)

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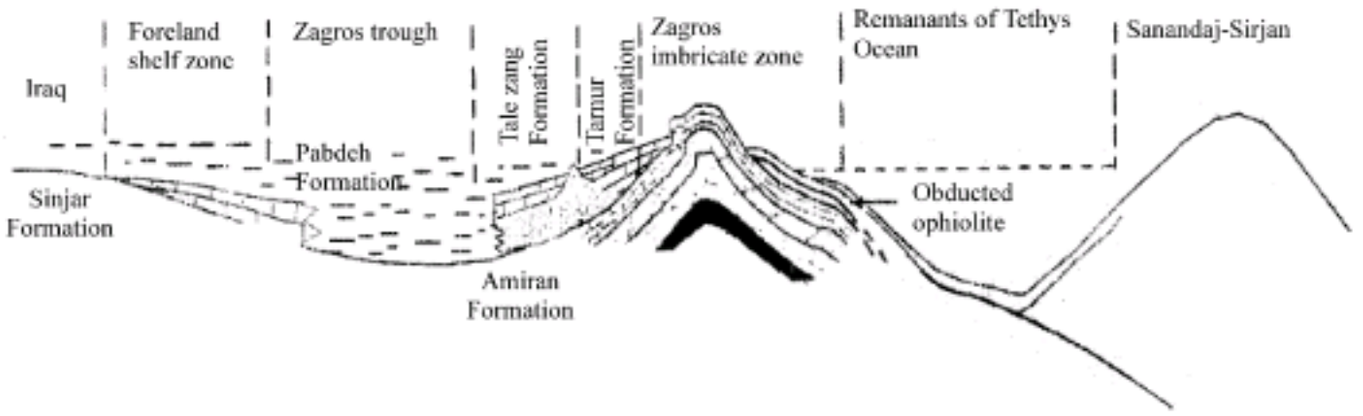

Fig. 2: Schematic cross-section through Zagros basin in Campanian-Mastrichtian

In north margin of Arabian plate, compressional stresses illustrated by the uplift of main Zagros reverse fault and High Zagros fault. This compression commend in Iran, Iraq and Oman in Middle Turonian with the initiation of obduction of ophiolith complex. This resulted deep water foreland basin along northeast plate margin (Lippard *et al*., 1986).

Foreland basin was in turn separated from what remained of Neotethys by a NW-SE trending high which later formed the Zagros imbricated zone (Stoneley, 1974).

The Gurpi Formation was deposited during Santonian-Middle Paleocene along the main through in an upwelling and foredeep environment. Also, late Cretaceous orogenic phase (Laramid) caused uplift of imbricated zone. The products of this phase were turbidity deposits along the main thrust Zagros (Amiran Formation).

According to the eustatic curve of Haq *et al*. (1988) a eustatic transgressive occurred in Middle Campanian-Maastrichtian. During this time, an association of rudist-rich thrived sediment was formed along the Southeastern Neotethys (Stubar and Loser, 2000). This rock unit is called Tarbur Formation in Zagros Mountains (Fig. 2).

James and Wynd (1965) gave the name Tarbur Formation to a carbonate sequence of Campanian-Maastrichian. Biostratigraphic criteria of the Tarbur Formation was Studied by Wynd (1965) that divided this formation into two biozones, *Monolepidobis-Orbitpides* Assemblage zone (Campanian in age) and *Omphalucyclus-Loftusia* Assemblage zone (Masstrichtian in age).

James and Wynd (1965), Kalantari (1976), Khosrow-Tehrani and Afghah (2004) and Maghfuri (2006) reviewed and described the lithological and micro faunal characterizes of the Tarbur Formation. Most investigation of this formation is based at interior Fars (Southern interior imbricated zone). In this area, Tarbur Formation lies between Gurpi Formation at the base and Sachun Formation at the top. But toward Northwest, in Balgar section, the sediments of the Tarbur Formation lie between Gurpi and Amiran Formations. In Robat and Chamsangar sections, this formation lies between Amiran Formation at the base and Kashkan Formation at the top.

LITHO-STRATIGRAPHY

Lithological characteristics of the Tarbur Formation at the Sarvestan section consist of 400 m limestone which divided in to two parts. Lower part consists of massive rudist bearing gray limestone, slightly dolomitized at basal part and medium rudist bearing white limestone (188 m) at top. Irons nodular are present at exposed layer of Tarbur Formation.

At Balgar section, Tarbur Formation consists of medium to massive organodetrial gray limestone (101 m).

The thickness of Tarbur Formation in Chamsangar section is 71 m and consists of thick light gray limestone. In Robat section, the thickness of Tarbur Formation is 61 m and contains of medium gray limestone with amount of rudist fragment.

BIOSTRATIGRAPHY

The following benthonic foraminifera are identified in limestone of the Tarbur Formation at Sarvestan (Fig. 3a):

Omphalocyclus macroporus, *Loftusia coxi*, *L. minor*, *L. morgani*, *Sidrolites calcitropoides*, *Rotalia* c.f *trochidiformis*, *Lepidorbitoides* sp., *Orbitoides apiculata*, *Antalyna korayil*.

The following microfauna are identified in the sediments of the Tarbur Formation at Balgar section (Fig. 3b):

Omphalocyclus macroporous, *Loftusia minor*, *Loftusia* sp., *Dicyclina* sp. and *Valvulammina* sp.

In Chamsangar section, the following benthonic foraminifera are identified (Fig. 3c, 4a-h):

Omphalocyclus macroporous, *Orbitides media*, *Loftusia minor*, *L. elongata*, *Sidrolites calcitropoides*, *Rotalia skorensis* and *Minoxia* sp.

The following index microfauna are identified in Robat section (Fig. 3d):

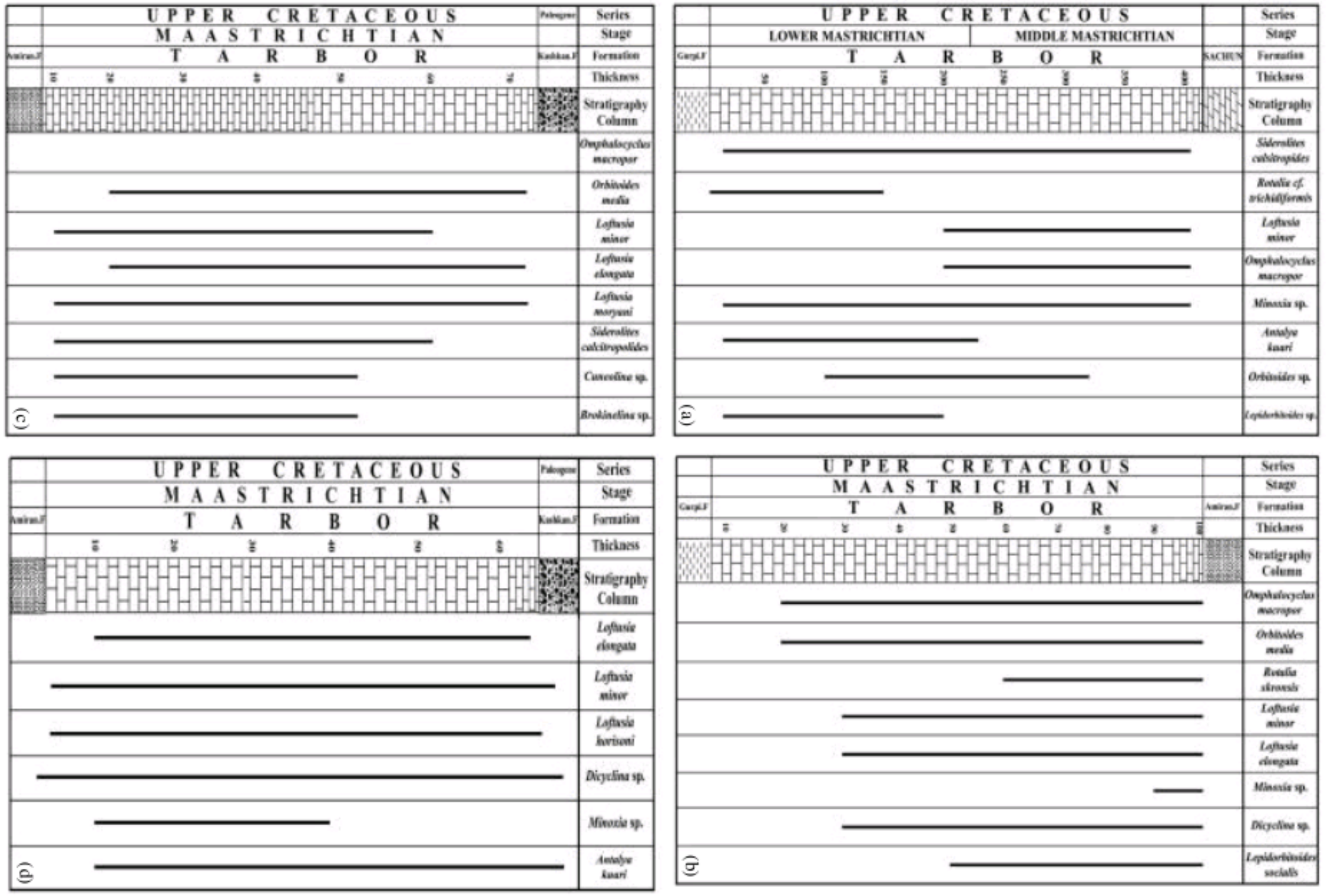

Fig. 3: Selected faunal distribution of the Tarbur Formation at: (a) Sarvestan, (b) Balgar, (c) Chamsangar and (d) Robat sections

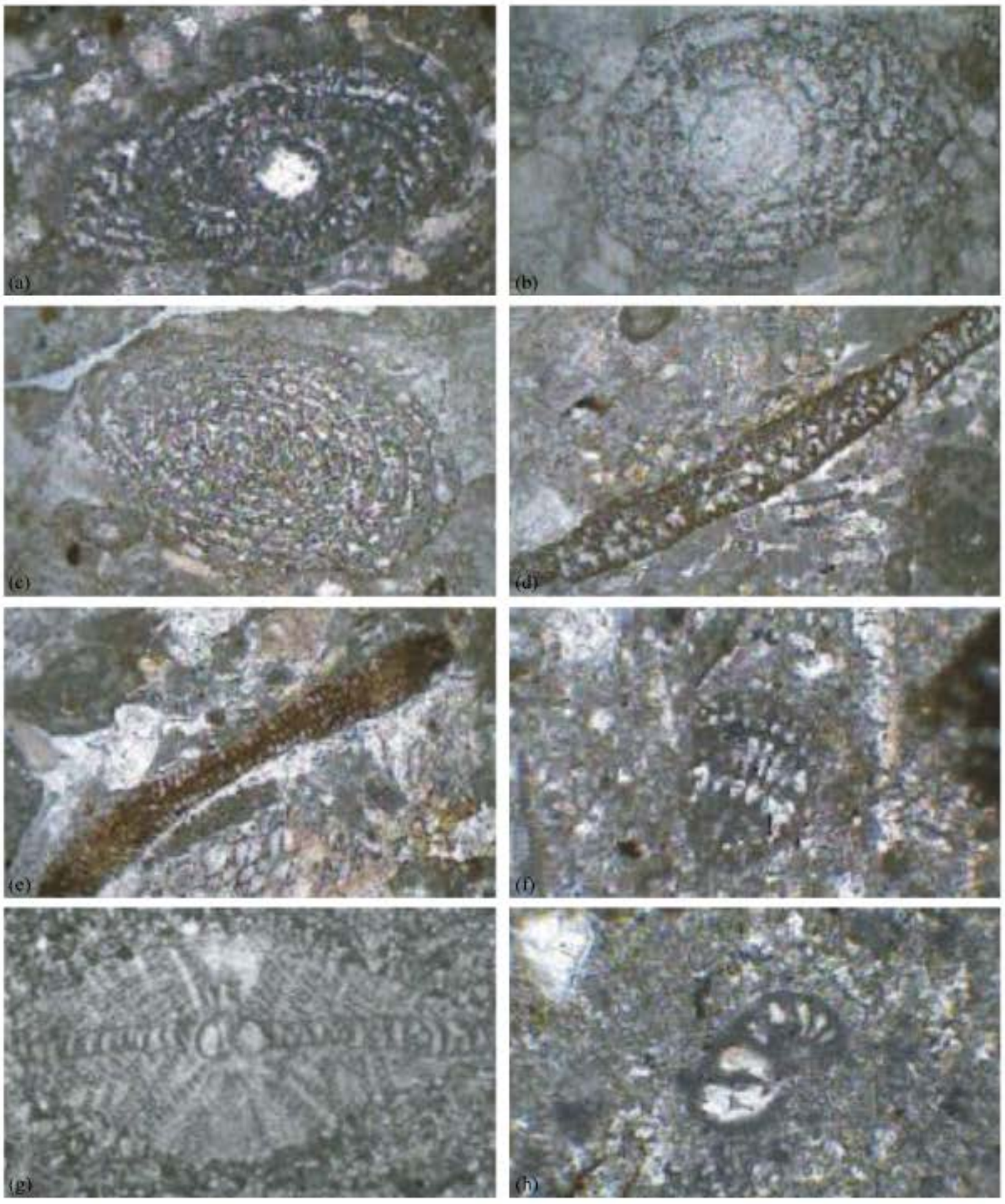

Fig. 4: Representative foraminifera of the Tarbur Formation, (a): *Luftosia harisoni*, Equatorial section (X17), Sample No. Tar-26; (b): *Luftosia minor*, Axial section (X17), Sample No. Tar-30; (c): *Luftsia elongata*, Axial section (X17), Sample No. Tar-26; (d): *Dicyclina* sp., Equatorial section (X17), Sample No. Tar-30; (e): *Omaphalocyclus* sp., Axial section (X17), Sample No. Tar-19; (f): *Cuneolina* sp., Axial section (X17), Sample No. Tar-3; (g): *Obitoides media*, Axial section (X40), Sample No. Tar-21 and (h): *Valvulammina* sp., Axial section (X17), Sample No. Tar-19

Loftusia elongata, *L. minor*, *L. coxi*, *L. harisoni*, *Dicyclina* sp., *Minoxia* sp. and *Antalynia korayi.*

Based on these assemblages of microfauna and comparison with other parts of Middle East (Al Sharhan and Nairn, 1990; Al Sharhan and Kendal, 1991; Henson, 1948) and with other distribution of Loftusia (Meric and Mojab, 1977) the outcrops of the Tarbur Formation at Sarvestan section is Early-Middle Maastrichtian and in other studied section is Middle Maastrichtian in age.

DISCUSSION

Tarbur Formation is predominantly Carbonate unit in the Imbricated zone (southwest of Iran) and contains of rich association of larger foraminifera. Because of absent of planktonic foraminifera biocorrelation of the Tarbur Formation with international subdivision of Cretaceous time scale is difficult. So, Wynd (1965) did not divided Campanian or Masstrichtian stages to substages, based

on the larger foraminifera, in the Tarbur Formation. Publications dealing with larger foraminifera of the Zagros and other part of southern Neothetys are relatively few, despite there being many exposures that yield them. Meriç and Mojab (1977) and Meric and Gormuz (2001) noted the biostratigraphicaly importance of *Loftusia* species in Southern Neotethys. They divided Maastrichtian by ranges of the different species of *Loftusia*. Based on *Loftusia* species and other microfauna, the exposed rocks of the Tarbur Formation at Sarvestan is Early-Middle Maastrichtian and in Balgar, Chamsangar and Robat sections is Middle Maastrichtian.

The index foraminifera of Campanian age could not find at studied section. The *Loftusia* associations, reported in this study are most abundant foraminifera in Maastrichtian carbonate rocks which known from other parts of Southern Neotethys.

Comparison of the Early-Middle Maastrichtian *Loftusia* species indicates broad similarity with those of the same age from Turkey, Iraq, Saudi Arabia, Oman (Meric and Mojab, 1977; Meric and Gormuz, 2001).

These similarities suggest that they were part of southern margin of Neotethys Ocean until there are no reports of the occurrence of *Loftusia* in other part of Iran.

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