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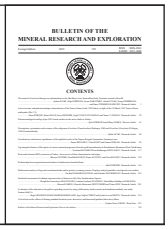

Descriptions, systematics and revisions of the subgenera *Alveolina* (*Glomalveolina*) Hottinger, 1960 and *Alveolina* (*Alveolina*) d'Orbigny, 1826 (Foraminiferida)

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Research Article

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Subgenus, *Alveolina* (*Glomalveolina*), *Alveolina* (*Alveolina*), *Systematic paleontology.*

ABSTRACT

In this study, the genus *Alveolina* D' Orbigny, 1826 and its *Alveolina (Alveolina)* D' Orbigny, 1826 and *Alveolina (Glomalveolina)* Hottinger, 1960 subgenera were re-examined and identified. Systematics of the subgenera *Alveolina* (*Alveolina*)=*Alv.* (*Alv.*) and *Alveolina (Glomalveolina)*=*Alv.*(*Glomalv.*) have also been reviewed and revised. *Alv.* (*Glomalv.*) is considered as a subgenus, not a genus (?). Because, all the generic features of microspheric generations (fB) of these two subgenera are identical. Thus, *Alveolina* D' Orbigny, 1826 and *Glomalveolina* Hottinger, 1960 cannot be used as if they were two different genera (?). Otherwise *Glomalveolina* would be the synonym of *Alveolina* in "Systematic Paleontology" chapter. Therefore, *Alv.* (*Alv.*) and *Alv. (Glomalv.*) are both subgenusses, and the structural difference between these subgenera is observed seen in their megalospheric generations (fA). Besides, description of the genus (?) *Glomalveolina* has never been made in any of the studies in which *Glomalveolina* is referred as genus (?). However, the subgenus *Alv.* (*Glomalv.*) has incorrectly been used by many authors as "genus (?) *Glomalveolina* Hottinger, 1960 or 1962".

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1. Introduction

Reichel (1937, p.80) examined Thanetian aged, small sized, spherical or subspherical shaped alveolinids, and realised that nepionic stage (just after the protoconch) of megalospheric generations (fA) of these alveolinids had triloculine chambers in one or two planes, and these chambers were followed by biloculine chambers. It especially differs, with the presence of triloculine chambers, from nepionic stage of the megalospheric generations (fA) of the genus *Alveolina* D' Orbigny (1826). Because, nepionic stage (just after the protoconch) of megalospheric generation (fA) of the genus *Alveolina* has only biloculine chambers. Therefore, Reichel (1937, p.80) proposed a new subgenus in order to indicate this difference (the presence of triloculine chambers in one or two planes) and named as "s.gen. *Glomalveolina* nom.nov.". However, Reichel (1937) is not the author of the subgenus "s.gen. *Glomalveolina* nom.nov.". Because, Reichel (1937, p.80) in that paper, described a new alveolinid species as "*Alveolina primaeva* n.sp" but not as "s.gen. *Glomalveolina primaeva* n.sp.". Therefore, Reichel (1937, p.80) is the first author who proposed the subgenus *Glomalveolina* or he can be considered as the author who has only the rights of the name of the subgenus *Glomalveolina*. The subgenus *Alveolina* (*Glomalveolina*)=*Glomalveolina* s.str.=*Alv.* (*Glomalv.*) Hottinger, 1960 was first described and its systematics was done by Hottinger (1960, p.26, 52) in his PhD thesis, hence he is the author of the subgenus *Alv.* (*Glomalv.*) and its year of publication is 1960 (Figure 1). Cover page of Hottinger's PhD thesis is given below for settling the controversies on the year of the publication of the subgenus *Alv.*(*Glomalv.*) (Figure 1). The year 1960 is clearly observed on the

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original cover page of the PhD (Figure 1). So, the year of publication of the subgenus *Alv.*(*Glomalv.*) is not 1962 (Figure 1). On the other hand, Hottinger has no single author paper in 1962! *Glomalveolina* s.str. (in the strict sense) means the subgenus *Glomalveolina* (Prof. Dr. Kuniteru Matsumaru, personal communication; Acar, 1995, p.11).

Many scientists including Hottinger, used the name "subgenus *Alveolina* (*Glomalveolina*) Hottinger, 1960" as "Hottinger, 1960" by referring Hottinger's PhD thesis (Figure 1) (Loeblich and Tappan, 1964; Sirel, 1972, 1975, 1976, 1986, 1998, 1999; Hottinger, 1974; Sirel and Gündüz, 1976; Sirel et al, 1983, 1986; Drobne, 1977; Rahaghi, 1978, 1983; Sartorio and Venturini, 1988; Acar, 1995).

The subgenus *Alv.*(*Glomalv.*) was widely used as a subgenus between the years 1958-1998 (Hottinger, 1958, p. 447, fig. 6f; 1960, p. 26, 52, Pl. 1, figs. 1-33; Pl. 2, figs. 9, 25; 1974, p. 34, fig. 17; Pl. 31, figs. 1-9; Pl. 32, figs. 1-13; Loeblich and Tappan, 1964, p. C504, fig. 391, C509; Sirel, 1972, p. 278, Pl. I, fig. 3; 1975, p. 181; 1976, p. 90, fig. 2, Pl. I, p. 1-18; 1986, p. 154, figs. 2, 7; 1998, p. 63, Pl. 28, fig. 11; Pl. 29, figs. 1-13; Pl. 30, figs. 1-13; Pl. 31, figs. 6-12; 1999, figs. 2, 5; Sirel and Gündüz, 1976, Pl. XIV, fig. 6); Sirel et al, 1983, p. 151, Pl III, figs. 5-7; Drobne, 1977, p. 13, figs. 1a-e, fig. 2e, figs. 3f-i, figs. 4k-n, figs. 5o,p; Rahaghi, 1978, p. 43, Pl. 6, figs. 1-10; 1983, p. 49, Pl. 21, figs. 1-3,10; Sartorio and Venturini, 1988, p. 158; White 1992, p. 54, Table 1; Acar, 1995, p. 16, Pl. 1, figs. 1-11; Pl. 2, figs. 1-6; Pl. 3, figs. 1-9).

However, the subgenus *Alv.*(*Glomalv.*) has been used as a genus (?) since 1998 by some paleontologists including Hottinger (Loeblich and Tappan, 1987, p. 361, 363, Pl. 372, fig. 2; Pl. 376, figs. 6, 7; Hottinger, 1999, p. 388; 2006, p. 96, fig. 57; 2009, p. 7, 9; Bassi and Broglio, 1999, p. 232; Özcan et al, 2001, p. 339; 2010, p. 34, p. 46, fig. 19, p. 47, fig. 20; Çolakoğlu and Özcan, 2003; Sirel, 2004, p. 27, Pl. 27, figs. 5-12; Pl. 28, figs. 1-13; 2009, p. 420; 2010, p. 8, figs. 7; Özgen-Erdem et al, 2005, p. 403; Özgen-Erdem, 2008, p. 69, fig. 3; Sirel and Acar, 2008, p. 4, Pl. 1, figs. 1-8, Pl. 2, figs. 1-13, Pl. 3, figs. 1-16, Pl. 4, figs. 1-16; Pignatti et al, 2008, Pl. 5, fig. 5, Pl., 7, figs. 8a–b; BougDagher-Fadel, 2008, p. 307; Scheibner and Speijer, 2009, p. 210, figs. 11A-F; İbrahimpasic, 2012, p. 32,33).

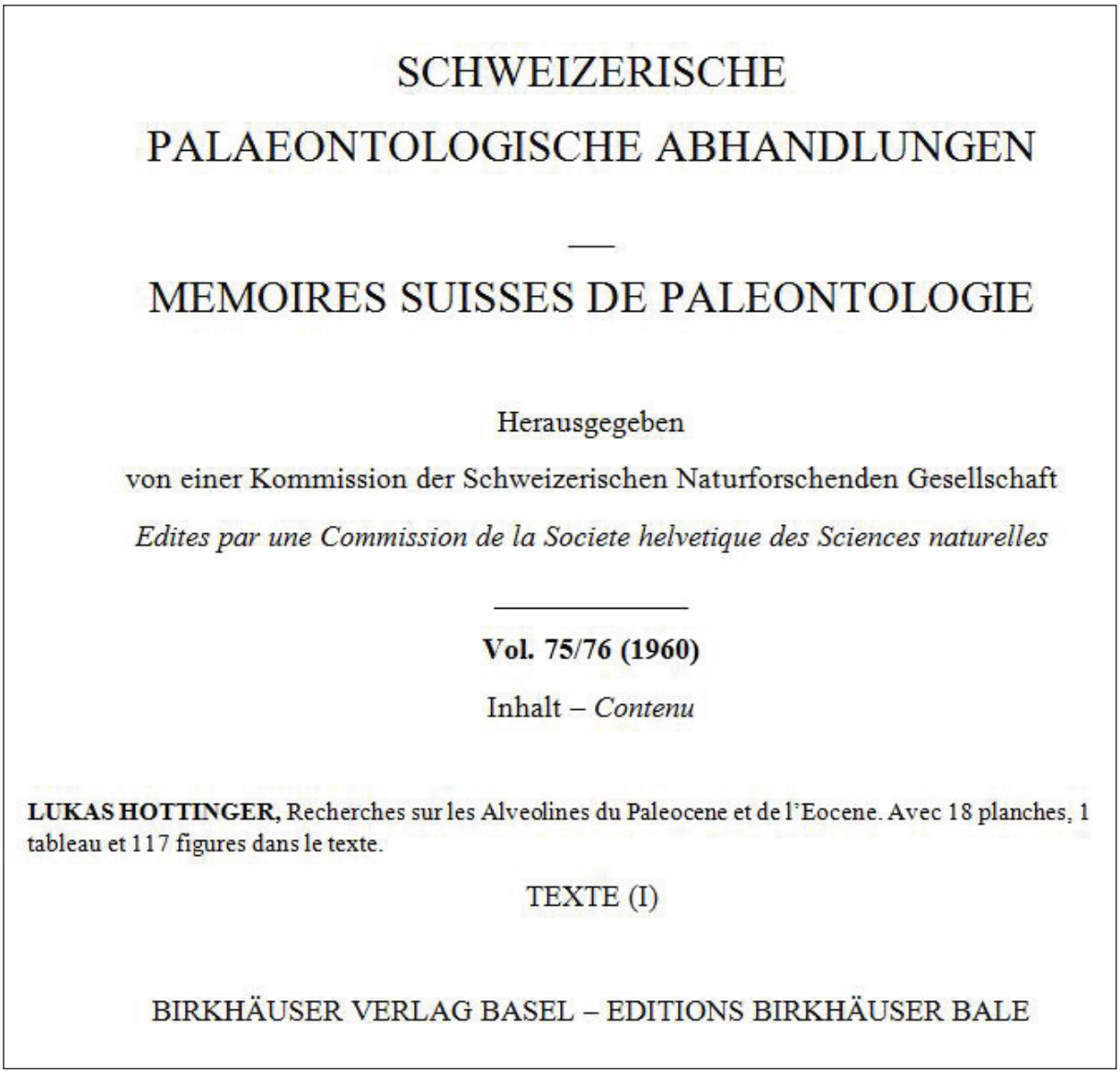
Remarks: This critical note is on the systematics of the alveolinids in the book about alveolinids written by Sirel and Acar (2008, p.4). *Glomalveolina* is referred as a genus in the book. This is the viewpoint of first author (Sirel). Second author (Acar) disagrees with this idea. The second author accepts *Alveolina* (*Glomalveolina*) as a subgenus.

There has been a confusion in systematic paleontology about Paleocene and Eocene glomalveolinids for 20 years (1998-2018). This paper is prepared in order to clarify this subject. *Alv.* (*Glomalv.*) is a subgenus, definitely not the genus "*Glomalveolina*". Because anybody has not made the description of the genus (?) "*Glomalveolina*" in any place up until today. Therefore, at first, well-known description of the genus *Alveolina* D' Orbigny (1826) which these two subgenus are linked to, is was made here in made and then the subgenera *Alveolina* (*Alveolina*) = *Alveolina* s.str.=*Alv.*(*Alv.*) D'Orbigny 1826 and *Alv.*(*Glomalv.*) Hottinger, 1960 were redescribed. *Alv.*(*Alv.*) and *Alv.*(*Glomalv.*) are both subgenusses. Because, generic features of microspheric generations (fB) of these two subgenera are all the same. In that case, "*Alveolina* D' Orbigny, 1826" and "*Glomalveolina* Hottinger, 1960/1962" whose microspheric forms (fB) are identical in generic characteristics, can't be two different genera. The genus *Alveolina* D' Orbigny, 1826 has been described earlier. In this case, *Glomalveolina* would be a synonym of *Alveolina*. Because of this reason, *Glomalveolina* can never be used as a separate genus. Therefore, *Alv.*(*Alv.*) and *Alv.*(*Glomalv.*) are both subgenusses. and the structural difference between them can only be observed in their megalospheric forms (fA). This structural difference could only be shown as "subgenus" in systematic paleontology (Figs. 2-4) (Hottinger, 1960, p.26, 52, 63). As it is observed, when determining alveolinid genera or species, axial sections of megalospheric (fA) individuals should be taken into consideration. Because, axial sections of alveolinids are more characteristic. While describing species/subspecies, new species or new subspecies especially from a smaller, spherical, subspherical or ovoid shaped *Alv.*(*Alv.*) or *Alv.*(*Glomalv.*), sections must be axial and magnification must be X40. Besides, microspheric (fB) forms should also be described.

2. Systematics and Generic Features of the Genus *Alveolina* D'Orbigny, 1826

In systematic paleontology (Loeblich and Tappan, 1964 and Acar, 1995) are followed.

Phylum: Protozoa GOLDFUSS, 1817,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Inhalt – *Contenu*

LUKAS HOTTINGER, Recherches sur les Alveolines du Paleocene et de l'Eocene. Avec 18 planches, 1 tableau et 117 figures dans le texte.

TEXTE (I)

BIRKHÄUSER VERLAG BASEL – EDITIONS BIRKHÄUSER BALE

Figure 1- Cover page of Lucas Hottinger's (1960) PhD thesis (original publication).

Subphylum: Sarcodina SCHAMARDA, 1871,

Class: Rhizopodea von SIEBOLD, 1845,

Order: Foraminiferida EICHWALD, 1830,

Suborder: Miliolina DELAGE AND HÉROUARD, 1896,

Super Family: Alveolinacea/Miliolacea EHRENBERG, 1839,

Family: Alveolinidae EHRENBERG, 1839,

Genus: ***Alveolina*** D'ORBIGNY, 1826,

Type Species: ***Oryzaria boscii*** DEFRANCE in BRONN, 1825.

1st Subgenus: ***Alveolina*****(*****Alveolina*****)** D'ORBIGNY, 1826,

1st Type Species: ***Oryzaria boscii*** DEFRANCE in BRONN, 1825,

2nd Subgenus: ***Alveolina*** **(*****Glomalveolina*****)** HOTTINGER, 1960,

2nd Type Species: ***Alveolina dachelensis*** SCHWAGER, 1883.

Genus: ***Alveolina*** D'Orbigny, 1826

Generic features: D'Orbigny (1826) first described the genus *Alveolina* in 1826. Reichel (1931, p.234; figure 1) explained the structural features of the genus

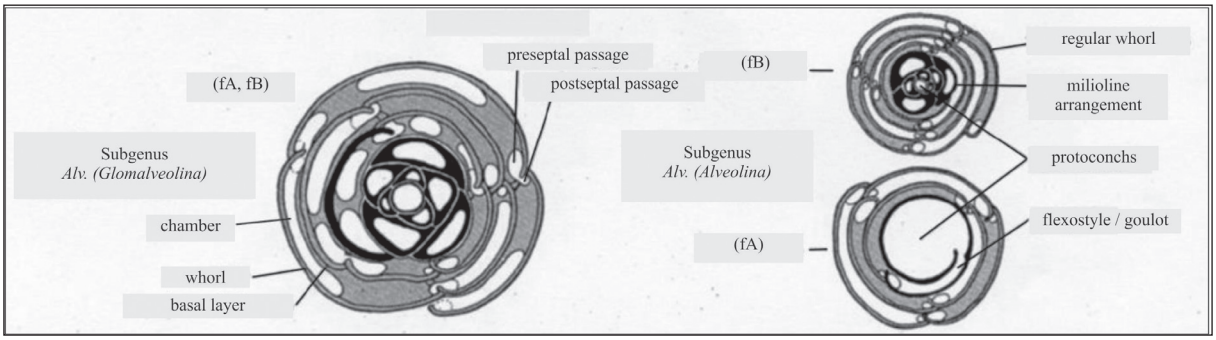

Figure 2- Equatorial sections of megalospheric and microspheric individuals of the subgenera *Alveolina* (*Glomalveolina*) Hottinger, 1960 and *Alveolina* (*Alveolina*) d'Orbigny, 1826, (Modified after Hottinger, 1960, p.26, figure 9).

Sous-genre Alveolina s.str.,

(Hottinger,1960, s. 63)

Figure 3- Systematics of the subgenus *Alveolina* (*Alveolina*) d'Orbigny, 1826 in the original publication (Hottinger, 1960, p.63).

52 L. HOTTINGER, ALVÉOLINES: II. DESCRIPTION SYSTÉMATIQUE

Description systématique

Sous-genre **GLOMALVEOLINA** REICHEL, 1937

Groupe d'*Alveolina* (*Glomalveolina*) *primaeva*

Figure 4- Systematics of the subgenus *Alveolina* (*Glomalveolina*) Hottinger, 1960 in the original publication (Hottinger, 1960, p.52).

Alveolina through figures. Some important studies on the structural elements of the genus *Alveolina* has been conducted later on (Reichel, 1937, p.7, figure 1; Hottinger, 1960, p.26, figure 9; Hottinger, 1974, p.22, figs. 10A-C). Generic features of the genus *Alveolina* are as follows:

1- Preseptal and postseptal canals are present (Figure 2) (Reichel, 1931, p. 294, fig. 1; 1937, p. 7, fig. 1; Hottinger, 1960, p. 26, fig. 9; 1974, p. 22, 34, figs. 10A-C; Loeblich and Tappan, 1964, C 506; Acar, 1995, p. 28, fig. 7, Pl. 38, figs. 1-3).

2- Aperture is consisting of two row of openings which are alternating in position. These apertures include main apertures located between septula and secondary apertures located at the base of septula or on the axis of septula (Reichel, 1931, p. 294, fig. 1; 1937, p. 7, fig. 1; Hottinger, 1960, p. 26, fig. 9; 1974, p. 22, 34, figs. 10A-C; Loeblich and Tappan, 1964, C 506; Acar, 1995, p. 28, fig. 7, Pl. 38, figs. 1-3).

3- Both the septula and the chamberlets are alternating in position (Reichel, 1931, p. 294, fig. 1; 1937, p. 7, fig. 1; Hottinger, 1960, p. 26, fig. 9; 1974, p. 22, 34, figs. 10A-C; Loeblich and Tappan, 1964, C 506; Acar, 1995, p. 28, fig. 7, Pl. 38, figs. 1-3). Dimorphism in the genus *Alveolina* is distinct.

Quinqueloculine, triloculine and biloculine chambers which follow very small spherical protoconch, are present in the axial sections of microspheric (fB) individuals. These biloculine chambers are subdivided into chamberlets by alternating septula (Hottinger, 1960, p. 26, fig. 9; Loeblich and Tappan, 1964, C 506; Acar, 1995, p. 28, fig. 7).

Biloculine chambers which follow the large protoconch, are present in the axial section of megalospheric (fA) individuals and these biloculine chambers are subdivided into chamberlets by alternating septula (Hottinger, 1960, p. 26, fig. 9;

Loeblich and Tappan, 1964, C 506; Acar, 1995, p. 28, fig. 7).

2.1. Systematics and Features of the Subgenus *Alveolina* (*Alveolina*) D'Orbigny, 1826

Family: Alveolinidae EHRENBERG, 1839,

Genus: *Alveolina* D'ORBIGNY, 1826,

Type Species: *Oryzaria boscii* DEFRANCE in BRONN, 1825,

1st Subgenus: *Alveolina*(*Alveolina*) D'ORBIGNY, 1826

1st Type Species: *Oryzaria boscii* DEFRANCE in BRONN, 1825.

1st Subgenus: *Alveolina*(*Alveolina*) D'Orbigny, 1826

Features of the subgenus: Features (canal structures, apertural openings, positions of septula) of the subgenus *Alv.* (*Alv.*) are completely same as in the genus *Alveolina* (Figures 2, 3) (Hottinger, 1960, p. 26, fig. 9, p. 63; Loeblich and Tappan, 1964, C 506; White 1992, p. 63; Acar, 1995, p. 28, fig. 7; 1996, p. 15).

Undivided quinqueloculine and triloculine chambers with biloculine chambers which follow spherical protoconch, are observed in the axial sections of microspheric (fB) specimens. These biloculine chambers are also subdivided into chamberlets by alternating septula (Figure 2) (Hottinger, 1960, p. 26, fig. 9; Loeblich and Tappan, 1964, C 506; Acar, 1995, p. 28, fig. 7; 1996, p. 15).

Divided biloculine chambers are observed just after a large protoconch in the axial sections of megalospheric (fA) specimens. These biloculine chambers are also subdivided into chamberlets by alternating septula (Figure 2) (Hottinger, 1960, p. 26, fig. 9; Loeblich and Tappan, 1964, C 506; Acar, 1995, p. 28, fig. 7; 1996, p. 15).

2.2. Systematics and Features of the Subgenus *Alveolina* (*Glomalveolina*) Hottinger, 1960

Family: Alveolinidae EHRENBERG, 1839,

Genus: *Alveolina* D'ORBIGNY, 1826,

Type Species: *Oryzaria boscii* DEFRANCE in BRONN, 1825,

2nd Subgenus: *Alveolina*(*Glomalveolina*) HOTTINGER, 1960,

2ndType Species: *Alveolina dachelensis* SCHWAGER, 1883.

2nd Subgenus: *Alveolina* (*Glomalveolina*) Hottinger, 1960,

Features of the subgenus: Hottinger (1960, p.52) explained systematics and the features of the subgenus *Alveolina* (*Glomalveolina*) in his PhD (Figures 1, 2). The coiling patterns succeeding protoconch, canal structures, apertural openings and positions of septula in microspheric (fB) forms (which means all the features) of the subgenus *Alv.* (*Glomalv.*) are completely same as in the genus *Alveolina* so in the microspheric (fB) forms of the subgenus *Alv.* (*Alv.*) (Figures 2, 4) (Hottinger, 1960, p. 26, fig. 9, p. 63, Pl.1, figs. 1-33; Loeblich and Tappan, 1964, C 506; Drobne, 1977, p. 14, figs. 1-5; Sirel et al, 1983, Pl. III, figs. 5-7; White 1992, p. 54, Table 1; Acar, 1995, p. 28, fig. 7, Pl. 1, figs. 1-11, Pl. 2, figs. 1-6, Pl. 3, figs. 1-9). There is no structural difference between microspheric (fB) forms of these two subgenera.

Structural features of the megalospheric (fA) specimens are different in each subgenus (Figures 2) (Hottinger, 1960, p. 26, fig. 9; Loeblich and Tappan, 1964, C 506; Drobne, 1977, p. 14, figs. 1a, 1d, figs. 4k, l; Acar, 1995, p. 28, fig. 7). For instance, in the axial sections of megalospheric (fA) specimens of the subgenus *Alv.* (*Glomalv.*), undivided triloculine chambers which come just after the protoconch, are followed by divided biloculine chambers (Hottinger, 1960, Pl. 1, figs. 6, 7, 9, 12, 14, 16, 20, 23, 26, 29; Drobne, 1977, p. 14, figs. 1a, 1d, figs. 4k, l; Sirel et al, 1983, Pl. III, figs. 6, 7; Acar, 1995, p. 16; Pl. 1, figs. 2- 4, 7, Pl. 2, figs. 1, 3, 5, 6, Pl. 3, fig. 3)

In equatorial sections of megalospheric sections (fA) of the subgenus *Alv.* (*Glomalv.*); undivided triloculine chambers come just after the protoconch, these triloculine chambers are followed by septa of planispirally coiled whorls, canals and chambers before and after these septa, are also present (Figure 2) (Hottinger, 1960, p. 26, fig. 9, Pl. 1, figs. 7, 10, 13, 25, 28; Sirel et al, 1983, Pl. III, fig. 5; Acar, 1995, p. 16).

These chambers which are formed by the septa of planispirally coiled whorls in equatorial sections; correspond to the biloculine chambers that are subdivided into chamberlets by septula in axial sections. Especially, the presence of undivided triloculine chambers found in both axial and equatorial sections of megalospheric (fA) specimens of the subgenus *Alv.*

(*Glomalv.*) is the structural difference of the subgenus *Alv.* (*Glomalv.*) (Figure 2) (Hottinger, 1960, p. 26, fig. 9; Loeblich and Tappan, 1964, C 506; Acar, 1995, p. 16) (Figure 5). These triloculine chambers do not exist in the megalospheric (fA) specimens of the subgenus *Alv.* (*Alv.*).

2.3. Structural Difference Between The Subgenera *Alveolina* (*Glomalveolina*) Hottinger, 1960 And *Alveolina* (*Alveolina*) D'Orbigny, 1826

The presence of undivided triloculine chambers found in axial and equatorial (in one or two plans) sections of megalospheric (fA) specimens of the subgenus *Alv.* (*Glomalv.*) is an important structural difference of the subgenus *Alv.* (*Glomalv.*)

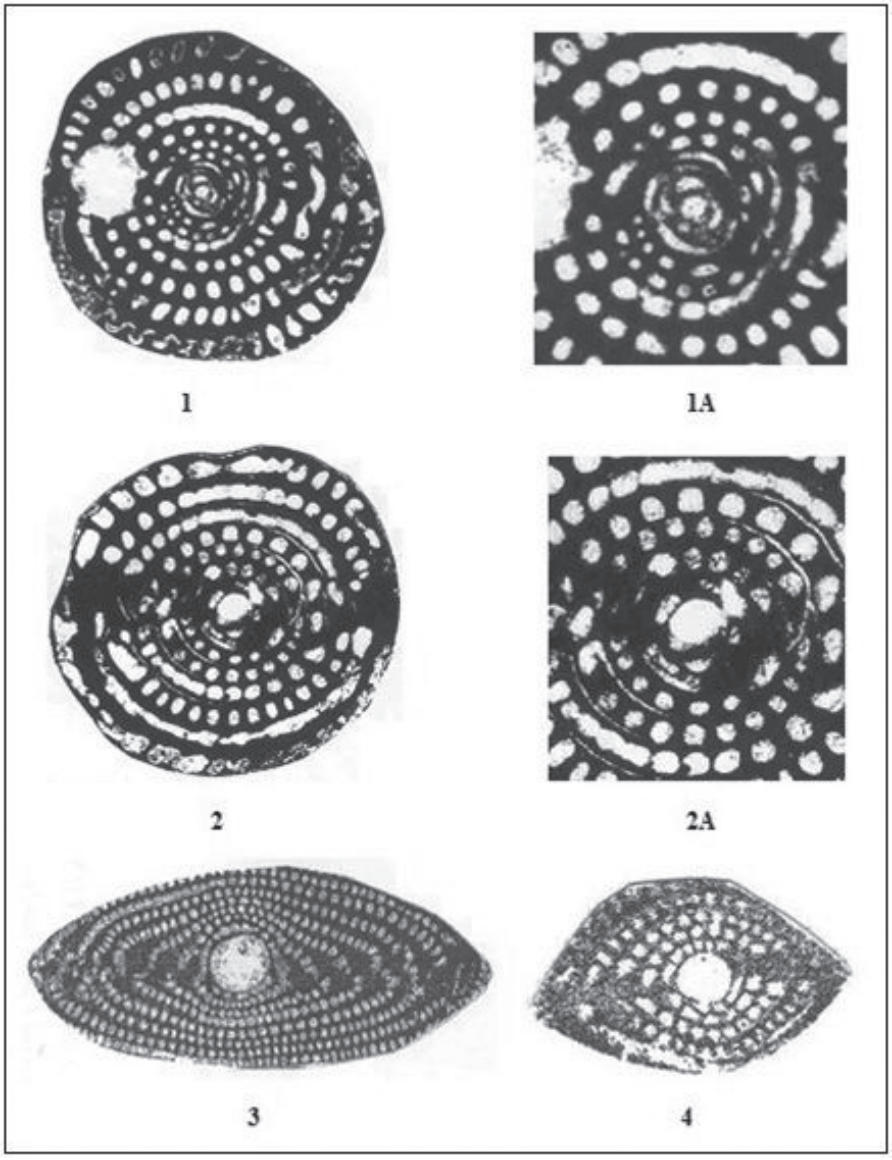

Figure 5- Axial sections of megalospheric (fA) specimens of the subgenera *Alv.*(*Glomalv.*) Hottinger, 1960 and *Alv.*(*Alv.*) d'Orbigny, 1826. 1, 2: *Alv.*(*Glomalv.*) *primaeva* (Reichel, 1937), early Thanetian, X40, (Acar, 1995, Pl. 1, figs. 3, 4). 1A, 2A: Enlarged photo of 1 and 2; protoconch, and the following undivided triloculine chambers and divided biloculine chambers are present in both figures. X75. 3: *Alv.*(*Alv.*) *corbarica* Hottinger, 1960, protoconch and the succeeding divided biloculine chambers are apparent, middle Ilerdian, X20, (Sirel and Acar, 2008, Pl. 38, fig. 6). 4: *Alv.*(*Alv.*) *erki* Acar, 1995, protoconch and the succeeding biloculine chambers which are subdivided into chamberlets are distinct, early Ilerdian, X40, (Acar, 1995, Pl. 3, fig. 10).

(Figure 2) (Hottinger, 1960, p. 26, fig. 9; Loeblich and Tappan, 1964, C 506; Acar, 1995, p. 16) (Figure 5). These triloculine chambers are not present in the megalospheric (fA) specimens of the subgenus *Alv.* (*Alv.*).

3. Conclusions and Suggestions

A- *Glomalveolina* Hottinger (1960) is not a genus. *Alv.*(*Alveolina*) d'Orbigny, 1826 and *Alv.* (*Glomalveolina*) Hottinger, 1960 are both subgenusses since all the generic features of their microspheric (fB) forms are the same (Figure 2) (Hottinger, 1960, p.26, fig. 9). Structural difference between these two subgenera can only be observed in the megalospheric (fA) forms (Figure 2) (Reichel, 1937, p. 80; Hottinger, 1960, p. 26, fig. 9). This structural difference could only be shown as "subgenus" in systematic paleontology (Figures 2-4) (Hottinger, 1960, p. 52,63; Loeblich and Tappan, 1964, C 506). Because of the reason that all the generic features of "*Alveolina*" and "*Glomalveolina*" are the same, these cannot be two different genera, so *Glomalveolina* can never be used as a genus. Since the genus *Alveolina* was first described in 1826, the genus (?) *Glomalveolina* 1960/1962 would be a synonym of the genus *Alveolina*. Consequently, *Alv.*(*Alveolina*) d'Orbigny, 1826 and *Alv.*(*Glomalveolina*) Hottinger, 1960 are both subgenusses, and each has to be used as "subgenus" in the systematic paleontology.

B- The author of the subgenus *Alv.* (*Glomalv.*) is not Reichel but is Hottinger, and the year of publications is not 1962 but is 1960 (Figure 1). Besides, Hottinger has no single author paper in 1962!

C- Axial, equatorial, tangential, and also oblique sections of megalospheric (fA) forms should be used when describing species/subspecies, new species or new subspecies (especially the small sized specimens) of all alveolinids (e.g. *Praebullalveolina* Sirel and Acar, 1982, *Bullalveolina* Reichel, 1937, *Borelis* De Montfort, 1808 and the subgenera *Alv.* (*Alv*) or *Alv.* (*Glomalv.*)). Positions of chambers which follow the protoconch and their internal structures could clearly be observed and examined in axial sections of especially megalospheric (fA) forms. This principle is also current when describing known alveolinid genera or a new genus. In general, standard (magnification) should be used for Late Cretaceous, Paleogene and Neogene alveolinids (Reichel, 1931, 1937; Hottinger, 1960; Drobne, 1977; Acar, 1995; Sirel and Acar, 2008). For instance, in the first description of (new) species *Alveolina* (*Alveolina*) *erki* Acar, 1995, magnification was used as X40, in order to compare with glomalveolinids and to discuss (Acar, 1995, p. 35, Pl. 3, figs. 10–13).

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