

***Torinosuella peneropliformis* (Yabe & Hanzawa, 1926) (Lituolacea, Foraminiferida) from the Early Cretaceous of the Pedraforca massif (Catalonian Pyrenees, NE Spain)**

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RESUMEN

CHERCHI, A. y SCHROEDER, R. *Torinosuella peneropliformis* (Yabe & Hanzawa, 1926) (Lituolacea, Foraminiferida) en el Cretácico inferior del macizo de Pedraforca (Pirineo catalán, España).

Se describe *Torinosuella peneropliformis* (Yabe & Hanzawa, 1926) proveniente del Hauteriviense superior - Barremiense inferior del macizo de Pedraforca (Pirineo catalán, España). Un análisis bibliográfico ha mostrado que esta especie aparece en el Titónico (superior?) y se extiende hasta el Hauteriviense superior - Barremiense inferior.

Palabras clave: Foraminíferos, Lituolacea, Pirineo catalán (España), Hauteriviense, Barremiense, Estratigrafía.

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ABSTRACT

The lituolacean foraminifer *Torinosuella peneropliformis* (Yabe & Hanzawa, 1926) from the upper Hauterivian - lower Barremian of the Pedraforca massif (Catalonian Pyrenees, NE Spain) is described and figured. A bibliographic analysis reveals that this species appears in the (upper?) Tithonian and ranges to the upper Hauterivian-lower Barremian.

Key words: Foraminifers, Lituolacea, Catalonian Pyrenees (Spain), Hauterivian, Barremian, Stratigraphy.

INTRODUCTION

The lituolacean genus *Torinosuella* Maync, 1959 (type and only species: *Choffatella peneropliformis* Yabe & Hanzawa, 1926) is a geographically wide-spread but rather rarely recorded taxon. *Torinosuella* was reported by several authors from Japan, Iran, Romania, Serbia, Italy, Spain and Portugal as occurring in a relatively large stratigraphic interval ranging from the Kimmeridgian to the Hauterivian.

The discovery of *Torinosuella peneropliformis* in the Pedraforca massif (Catalonian Pyrenees) (Ullastre & Masrera 2004, p. 22) has given rise not only to publication of this new material but also to a discussion of the stratigraphic distribution of this species.

GEOLOGICAL SETTING

Ullastre & Masrera (2004) have recently presented in this journal a stratigraphic analysis and a detailed geological cartography of the Pedraforca massif providing new insights into the sedimentary and tectonic evolution of this impressive mountain. During field-work a number of Lower Cretaceous samples were collected and studied by one of us (R.S.). One of these samples contains numerous specimens of *Torinosuella peneropliformis*, which are the subject of the present study.

According to Ullastre & Masrera (2004, p. 22), this sample was collected at the northern foot of the Pollegó superior (northern part of the Pedraforca massif). Ascending to La Piràmide, these authors mention 30-40 m thick-bedded limestones overlying with mechanical contact the Dogger-Malm dolomites. The sample containing *Torinosuella* was taken 3 m above the base of this limestone series. Next follows a red ferruginous breccia (0.2 to 0.8 m), impregnated with hematite, which is overlain by limestones (2 m) with *Choffatella decipiens* Schlumberger and *Orbitolinopsis praesimplex* Schroeder, the latter indicating a lower Aptian age.

The sample containing *Torinosuella peneropliformis* is a biomicrite with frequent gastropod and pelecypod fragments. Smaller benthic foraminifers are represented by indeterminate miliolids and biserial forms, *Vercorsella* sp., *Glomospira* sp., and *Sabaudia minuta* (Hofker, 1965). Of special stratigraphic interest, however, is the rare occurrence of the orbitolinid foraminifer *Urgonina alpillensis* (Foury,

1963) (Pl. 1, figs. 14-15) indicating an upper Hauterivian - lower Barremian age. The relatively frequent dasyclad fragments (determined by M. Conrad, Genève) are represented by the following species: *Salpingoporella muehlbergii* (Lorenz, 1902), *Salpingoporella* cf. *hispanica* Conrad, 1975, *Biokoviella?* sp. cf. *B. robusta* (Sokac), *Korkyrella texana* (Johnson, 1965) and *Vederosella alimani* Dragastan, 2000. According to M. Conrad, this microflore indicates likewise an upper Hauterivian - lower Barremian age.

DESCRIPTION OF *TORINOSUELLA PENEROPLIFORMIS*

Torinosuella peneropliformis (Yabe & Hanzawa, 1926)

Pl. 1, figs. 1-13

- 1926 *Choffatella peneropliformis* nov.; Yabe & Hanzawa: pl. 2, figs. 1-2
 1959 *Torinosuella peneropliformis* (Yabe & Hanzawa); Maync: pl. 1, figs. 6a-b, 7-10, 14, 16 [non figs. 1-4, 11-13 (= *Pseudospirocyclus maynci* Hottinger, 1967)]
 1964 *Torinosuella peneropliformis* (Yabe & Hanzawa); Loeblich & Tappan: text-figs. 145. 8-9 [non figs. 145. 7a-b (= *Pseudospirocyclus maynci* Hottinger, 1967)]
 1967 *Torinosuella* cf. *peneropliformis* (Yabe et Hanzawa); Hottinger: text-fig. 33
 1967 *Torinosuella peneropliformis* (Yabe et Hanzawa); Neumann: pl. 26, figs. 1-3, 6-9 [non text-fig. 100; pl. 26, figs. 4-5 (= *Pseudospirocyclus maynci* Hottinger, 1967)]
 1972 *Torinosuella* sp. aff. *peneropliformis* (Y. & H., 1926); Calzada Badia: pl. 1, figs. without numbers
 1975 *Torinosuella peneropliformis* (Yabe & Hanzawa); Dragastan: pl. 36, fig. 26; pl. 55, fig. 4; pl. 57, fig. 1
 1982 *Torinosuella* aff. *peneropliformis* Yabe & Hanzawa; Canérot & Cugny: text-figs. 5b-c
 1984 *Torinosuella* sp. aff. *peneropliformis* Yabe & Hanzawa [sic!]; Canérot: pl. 2, fig. 5
 non 1988 *Torinosuella peneropliformis* (Yabe and Hanzawa); Loeblich & Tappan: pl. 101, figs. 3-7 (= *Pseudospirocyclus maynci* Hottinger, 1967)
 1998 *Torinosuella peneropliformis* (Yabe & Hanzawa, 1926); Jerotijević-Polavder: pl. 1, figs. 1-6
 2003 *Torinosuella peneropliformis* (Yabe and Hanzawa); Bucur *et al.*: pl. 41, figs. 4-7

The original description of *Torinosuella peneropliformis*, given by Yabe & Hanzawa (1926, p. 11) and based on only two sections (Pl. 1, figs. 1-2 in this paper), runs as follows «Shell arenaceous, oval, complanate, planospiral, composed of numerous broad low chambers in peneropline growth; septa strongly arcuate, traversed by numerous pores arranged in a linear series (?). Shell-wall alveolar. Diam. 1.4 mm.» We chose the equatorial section figured by Yabe & Hanzawa (pl. 2, fig. 1) as the lectotype of this species.

The specimens from the Pedraforca massif show essentially the same characteristics as the Japanese type-material. A small bilocular embryo (Pl. 1, fig. 7; diameter: 0.05 mm) is situated at the beginning of a well-developed complanate planispiral (Pl. 1, figs. 5-7). This latter stage is followed by a series of arcuate chambers forming the likewise complanate, flabelliform part of the test (Pl. 1, figs. 8-10). The peripheral part of the chambers is subdivided into a layer of minute chamberlets (Pl. 1, fig. 3) by small septula (Pl. 1, fig. 13). Neighbouring chambers are generally connected by a single row of apertures, but their irregular distribution in the septa of the adult stage cannot be excluded.

In contrast to the Japanese lectotype, the Pedraforca specimens are in part coarsely agglutinated; the foreign particles have a diameter up to 0.07 mm (Pl. 1, figs. 4, 8-9, 12-13). Specimens from other *Torinosuella* populations also show sporadic coarse and irregularly distributed grains which are utilized in test construction (Dragastan 1975, pl. 55, fig. 4; Jerotijević-Polavder 1998, pl. 1, figs. 1-2, 5).

STRATIGRAPHIC DISTRIBUTION OF *TORINOSUELLA PENEROPLIFORMIS*

According to Yabe & Hanzawa (1926, p. 11), the original material of «*Choffatella*» *peneropliformis* comes from the «Torinosu Limestone» of Iwasa-Kompirayama, in the vicinity of Sakawa (province of Tosa, Shikoku, Japan); the age of this limestone is given as «either lowest Cretaceous or uppermost Jurassic.» Kano & Jiju (1995) have subdivided the Torinosu Group in western Shikoku into the Tsukadani Formation, composed mainly of coarse-grained siliciclastic rocks, and the Yatsuji Formation, consisting of mudstone, limestone and small amount of marlstone. Radiolarians indicate a Kimmeridgian-early Tithonian age for the Tsukadani Formation and the basal part of the Yatsuji Formation, whereas the overlying rest of the latter Formation yields radiolarians of late Tithonian-Valanginian (Aita & Okada 1986; Kano & Jiju 1995; Shiraishi & Kano 2004). It follows that *Torinosuella peneropliformis* described by Yabe & Hanzawa from limestones of the Torinosu Group occurs within the Tithonian-Valanginian time interval.

Maync (1959) described *Torinosuella peneropliformis* from the «Kimmeridgian» of Cape Espichel, Portugal (associated with *Anchispirocyclus lusitanica*), the Hauterivian (dated by ostracods) of the Topcider river near Beograd (Serbia), and from the Jurassic - Cretaceous boundary of the Engelhorn-Titlis chain (Switzerland). However, Hottinger (1967) pointed out that the Portuguese sections figured by Maync (1959, pl. 1, figs. 11-13) belong in reality to *Pseudospirocyclus maynci* Hottinger (now assigned to *Anchispirocyclus*), although they seem to be associated in the same horizon with true *T. peneropliformis* (Ramalho 1969, 1971). Nevertheless, the sections belonging to *P. maynci* are refigured in the treatise of Loeblich & Tappan (1988) under the wrong name *Torinosuella peneropliformis*. The dating of the Cape Espichel horizon by Maync (1959) as Kimmeridgian was incorrect; it is located in the uppermost part of the «Portlandian B» *sensu* Ramalho (1971) of upper Tithonian age.

Jerotijević-Polavder (1998) described *T. peneropliformis* from the Berriasian - lower Valanginian of the Kurilovo anticline (Serbia) dated by dasyclads, mainly *Salpingoporella steinhauseri*.

Dragastan (1975) figured *T. peneropliformis* from the Berriasian - lower Valanginian of the Ghilcoş Mountains (eastern Carpathians, NE Romania), where it occurs within the «*Macroporella embergeri* Zone» and the «*Feurtillia frequens* Zone».

Bucur *et al.* (2003) assumed a «late Valanginian? - Hauterivian - Barremian?» age for *T. peneropliformis* from a locality near Yazd (central Iran).

Azéma *et al.* (1977) reported *Torinosuella* sp. (not figured) from the lower Valanginian of San Antioco (SW Sardinia), dated by calpionellids (*Calpionellites darderi*, *C. oblonga*, *Tintinnopsella* gr. *carpathica*, *T. gr. longa*).

Calzada Badia (1972) described «*Torinosuella* sp. aff. *peneropliformis*» from the Early Cretaceous of the Garraf massif near Barcelona (NE Spain), where it occurs with «*Choffatella* sp. cf. *decipiens*» in marly horizons, which are intercalated in a 100 m thick limestone series. These limestones contain the orbitolinid *Valdanchella miliani* (det. J. Canérot) indicating a lower Valanginian age; they are overlain with tectonical contact by a 200 m thick series of limestones and marls with *Torinosuella* and *Choffatella decipiens*, which are attributed to the Hauterivian.

Canérot (1982, 1984) reported «*Torinosuella* sp. aff. *peneropliformis*» from several horizons of the «Calcaires et Marnes du Mas de Querol» Formation (Castellón province, eastern Iberian Chains), which he attributed to the Hauterivian. From the basal part of this Formation the same author figured (1984, pl. 2, figs. 16-17) under the name «*Paleodictyoconus* n. sp.» two random sections of a large orbitolinid foraminifer, which belong in our opinion to the genus *Valserina*, thus indicating uppermost Hauterivian or lower Barremian.

Summing up, it may be said that *Torinosuella peneropliformis* appears in the (upper?) Tithonian and ranges in some regions of Spain (Catalonian Pyrenees, Iberian Chains) to the upper Hauterivian - lower Barremian. However, the presence of this species already in the Kimmeridgian, recorded by numerous authors, cannot be confirmed.

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REFERENCES

- Aita Y. & Okada, H. 1986. Radiolarians and calcareous nannofossils from the uppermost Jurassic and Lower Cretaceous strata of Japan and Tethyan regions. *Micropaleont.*, **32**: 97-128.

- Azéma, J., Chabrier, G., Fourcade, E. & Jaffrezo, M. 1977. Nouvelles données micro-paléontologiques, stratigraphiques et paléobiogéographiques sur le Portlandien et le Néocomien de Sardaigne. *Rev. Micropaléont.*, **20**(3): 125-139.
- Bucur, I. I., Senowbari-Daryan, B. & Majidifard, M. R. 2003. Neocomian microfossil association from the Taft area near Yazd (central Iran). *Facies*, **48**: 217-222.
- Calzada Badia, S. 1972. *Torinosuella* sp. y *Coprulus* sp. en el Valanginiense y Hauteriviense de Garraf. *Rev. española Micropaleont.*, núm. extraord. (XXX Anivers. E. N. Adaro): 51-58.
- Canérot, J. 1984. Fluctuations marines et évolution biologique: exemple du Néocomien des Ibérides orientales (Espagne). In: Oertli, H. J. (Ed.) *Benthos '83; 2nd Int. Symp. Benthic Foraminifera* (Pau, April 1983): 131-139.
- Canérot, J. & Cugny, P. 1982. La plate-forme hauterivienne des Ibérides sud-orientales (Espagne) et ses environnements bio-sédimentaires. *Cret. Res.*, **3**(1-2): 91-101.
- Dragastan, O. 1975. Upper Jurassic and Lower Cretaceous microfacies from the Bicz valley basin (east Carpathians). *Inst. Géol. [Bucarest]. Mém.*, **21**: 1-87.
- Hottinger, L. 1967. Foraminifères imperforés du Mésozoïque marocain. *Notes Mém. Serv. géol. Maroc*, **209**: 1-168.
- Jerotijević-Polavder, S. 1988. *Torinosuella peneropliformis* (foraminifer) u Donjoj kredi Srbije [*Torinosuella peneropliformis* (foraminifer) in Lower Cretaceous of Serbia]. *Radovi Geoinstituta [Bull. Geoinst.]*, **35**: 229-232.
- Kano, A. & Jiju, K. 1996. The Upper Jurassic - Lower Cretaceous carbonate-terrigenous succession and development of a carbonate mound in western Shikoku, Japan. *Sediment. Geol.*, **99**: 165-178.
- Loeblich, A. R. jr. & Tappan, H. 1964. Sarcodina chiefly «Thecamoebians» and Foraminiferida. In: Moore, R. C. (Ed.): *Treatise on Invertebrate Paleontology*, part C, Protista 2, vol. 1, 510 pp.
- Loeblich, A. R. jr. & Tappan, H. 1988. Foraminiferal genera and their classification. 2 vols.; 1: 970 pp.; 2: 212 pp., 847 pls., *Van Nostrand Reinhold Company*, New York.
- Maync, W. 1969. *Torinosuella* n. gen., eine mesozoische Gattung der lituoliden Foraminiferen. *Ecl. geol. Helv.*, **52** (1): 5-14.
- Neumann, M. 1967. Manuel de micropaléontologie des Foraminifères (systematique - stratigraphie). 297 pp., *Gauthier-Villars*, Paris.

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- Ramalho, M. M. 1969. Quelques observations sur les Lituolidae (Foraminifera) du Malm portugais. *Bol. Soc. geol. Portugal*, **17**: 37-50.
- Ramalho, M. M. 1971. Contribution à l'étude micropaléontologique et stratigraphique du Jurassique supérieur et du Crétacé inférieur des environs de Lisbonne (Portugal). *Serv. geol. Portugal, Mem.*, **19**: 1-212.
- Shiraishi, F. & Kano, A. 2004. Composition and spatial distribution of microencrusts and microbial crusts in upper Jurassic - lowermost Cretaceous reef limestone (Torinosu Limestone, southwest Japan). *Facies*, **50** (2): 217-227.
- Ullastre, J. & Masrera, A. 2004. Pedraforca: estratigrafía y estructura (Pirineo catalán, España). *Treb. Mus. Geol. Barcelona*, **12**: 11-52.
- Yabe, H. & Hanzawa, S. 1926. *Choffatella* Schlumberger and *Pseudocyclamina*, a new genus of arenaceous foraminifera. *Sci. Rep. Tôhoku Imp. Univ.*, Ser. 2, Geol., **9**(1): 9-11.

Plate 1

1-13. *Torinosuella peneropliformis* (Yabe & Hanzawa, 1926).

1. Somewhat oblique equatorial section, reproduced from Yabe & Hanzawa (1926: pl. 2, fig. 1). Lectotype, x32.
2. Transverse section, reproduced from Yabe & Hanzawa (1926: pl. 2, fig. 2). x32.
3. Oblique equatorial section (205-24), x50.
4. Oblique transverse section (205-15), x50.
5. Somewhat oblique equatorial section showing the spiral initial part of the test (205-19), x50.
6. Strongly inclined oblique equatorial section showing the spiral initial part of the test (205-20), x50.
7. Equatorial section through the spiral initial part of the test (205-18), x50.
8. Strongly inclined oblique equatorial section (205-26), x50.
9. Strongly inclined oblique equatorial section (205-18), x50.
10. Strongly inclined oblique equatorial section (205-23), x50.
11. Transverse section (205-17), x50.
12. Oblique transverse section (205-30), x50.
13. Transverse section (205-30), x50.
- 14-15. *Urgonina alpillensis* (Foury, 1963).
14. Tangential section (205-16), x50.
15. Strongly inclined oblique transverse section (205-28), x50.

Localities

- 1-2: Torinosu Limestone (Tithonian - Valanginian) from Iwasa-Kompirayama in the vicinity of Sakawa, province of Tosa (southwestern Japan).
 3-15: La Piràmide, northern side of the Pedraforca massif (Catalonian Pyrenees, NE Spain). Late Hauterivian - early Barremian.

Lámina 1

1-13. *Torinosuella peneropliformis* (Yabe & Hanzawa, 1926)

1. Sección ecuatorial un poco oblicua, reproducida de Yabe & Hanzawa (1926: pl. 2, fig. 1). Lectotipo, x32.
2. Sección transversal, reproducida de Yabe & Hanzawa (1926: pl. 2, fig. 2). x32.
3. Sección ecuatorial oblicua (205-24), x50.
4. Sección transversal oblicua (205-15), x50.
5. Sección ecuatorial un poco oblicua mostrando la espiral de la parte inicial de la concha (205-19), x50.
6. Sección ecuatorial oblicua fuertemente inclinada mostrando la espiral de la parte inicial de la concha (205-20), x50.
7. Sección ecuatorial a través de la espiral de la parte inicial de la concha (205-18), x50.
8. Sección ecuatorial oblicua fuertemente inclinada (205-26), x50.
9. Sección ecuatorial oblicua fuertemente inclinada (205-18), x50.
10. Sección ecuatorial oblicua fuertemente inclinada (205-23), x50.
11. Sección transversal (205-17), x50.
12. Sección transversal oblicua (205-30), x50.
13. Sección transversal (205-30), x50.
- 14-15. *Urgonina alpillensis* (Foury, 1963).
14. Sección tangencial (205-16), x50.
15. Sección transversal oblicua fuertemente inclinada (205-28), x50.

Localidades

- 1-2: Torinosu Limestone (Titónico - Valanginiense) de Iwasa-Kompirayama en las cercanías de Sakawa, provincia de Tosa (SW Japón).
 3-15: La Piràmide, cara N del macizo de Pedraforca (Pirineo catalán, NE España). Hauteriviense superior - Barremiense inferior.

