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Balanoidea (Crustacea, Cirripedia) from the Upper Marine Molasse (Early Miocene) of the Bern area, Switzerland

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ABSTRACT

Within the framework of an integral study of Burdigalian (late Early Miocene) faunas from the Upper Marine Molasse in the Bern area (Switzerland), the balanoids housed in the collections of the Natural History Museum Bern have been studied. Specimens are assigned to the subfamily of Archaeobalaninae and to the balanid subfamilies Concavinae and Megabalaninae. Only in a single case has it been possible to identify material at the specific level, namely in *Chesaconcavus gurlarnensis* CARRIOL & SCHNEIDER, 2008.

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RÉSUMÉ

Balanoidea (Crustacea, Cirripedia) de la Molasse marine supérieure (Miocène Inférieur) des environs de Berne, Suisse – Dans le contexte d'une étude intégrale de la faune burdigalienne de la Molasse marine supérieure des environs de Berne (Suisse) les Balanoides conservés dans les collections du Musée d'Histoire Naturelle de Berne ont été étudiés. Les spécimens ont été attribués à la sous-famille des Archaeobalaninae ainsi qu'à deux sous-familles de Balanidae, les Concavinae et les Megabalaninae. Une seule détermination a été possible au niveau spécifique, celle de *Chesaconcavus gurlarnensis* CARRIOL & SCHNEIDER, 2008.

Keywords: Cirripedia, Taxonomy, Molasse, Miocene, Burdigalian, Switzerland

Mots-clefs: Cirripedia, Taxinomie, Molasse, Miocène, Burdigalien, Suisse

Introduction

In a number of papers on the Molasse fauna near Bern there are records of balanoid cirripedes (Studer 1825; von Fischer-Ooster 1861; Bachmann 1867; Mayer 1872; Kissling 1890; Rutsch 1928). The Upper Marine Molasse of the study area (Fig. 1) in the vicinity of Bern (Switzerland) was deposited during the Early Miocene in the perialpine Molasse Basin (Pfister & Wegmüller 1994), in a transitional area between the western Paratethys (Rhône Basin) and the central Paratethys in the east.

Strata of Burdigalian age in this area are assigned to the Sense Beds (at the base), the Belpberg Beds and the Niedermatt Beds (at the top) (see Gruner 2001).

The Sense Beds comprise homogeneous sandstones with only few fossiliferous layers (Gruner 2001). Ever since the days of Ritter (1742), the fossil-rich Belpberg Beds have remained the focus of palaeontological and geological work. Studer (1825), Bachmann (1867) and Kissling (1890) described the fossil fauna around Bern. The work of Rutsch (1928) was for a long time the most comprehensive palaeontological and geological study of the Belpberg Beds. New data on sedimentological and stratigraphical aspects were supplied by Keller (1989) and Schoepfer (1989), and more recently, Pfister & Wegmüller (1994, 1998, 1999, 2000, 2001, 2007a, b) recorded the molluscan faunas, while Kroh & Menkveld-Gfeller (2006) documented the echinoids. Until now, balanids from the sediments were not studied in detail. Most of the Burdigalian Balanoidea studied herein originate from the Belpberg Beds, whereas some specimens were collected from the underlying Sense Beds.

For an overview of lithostratigraphy and palaeogeography of the Swiss Molasse, reference is made to Berger & al. (2005a, b). Gruner (2001) assigned the Sense Beds to the Lower Burdigalian, in view of their lithostratigraphic position (Schoepfer 1989); the Belpberg and Niedermatt beds are assigned a Middle Burdigalian age. For additional discussion on the age of the Belpberg Beds (and the "Helvetian", an obsolete term used for the time interval studied), we refer the reader to Harzhauser & al. (2003).

Material studied

With one exception, the collection of Balanoidea from the Burdigalian Upper Marine Molasse of the Bern area housed at the Natural History Museum Bern (NMBE) does not comprise any complete specimens. All are shells, without opercular plates, filled with an indurated sandstone matrix which cannot be

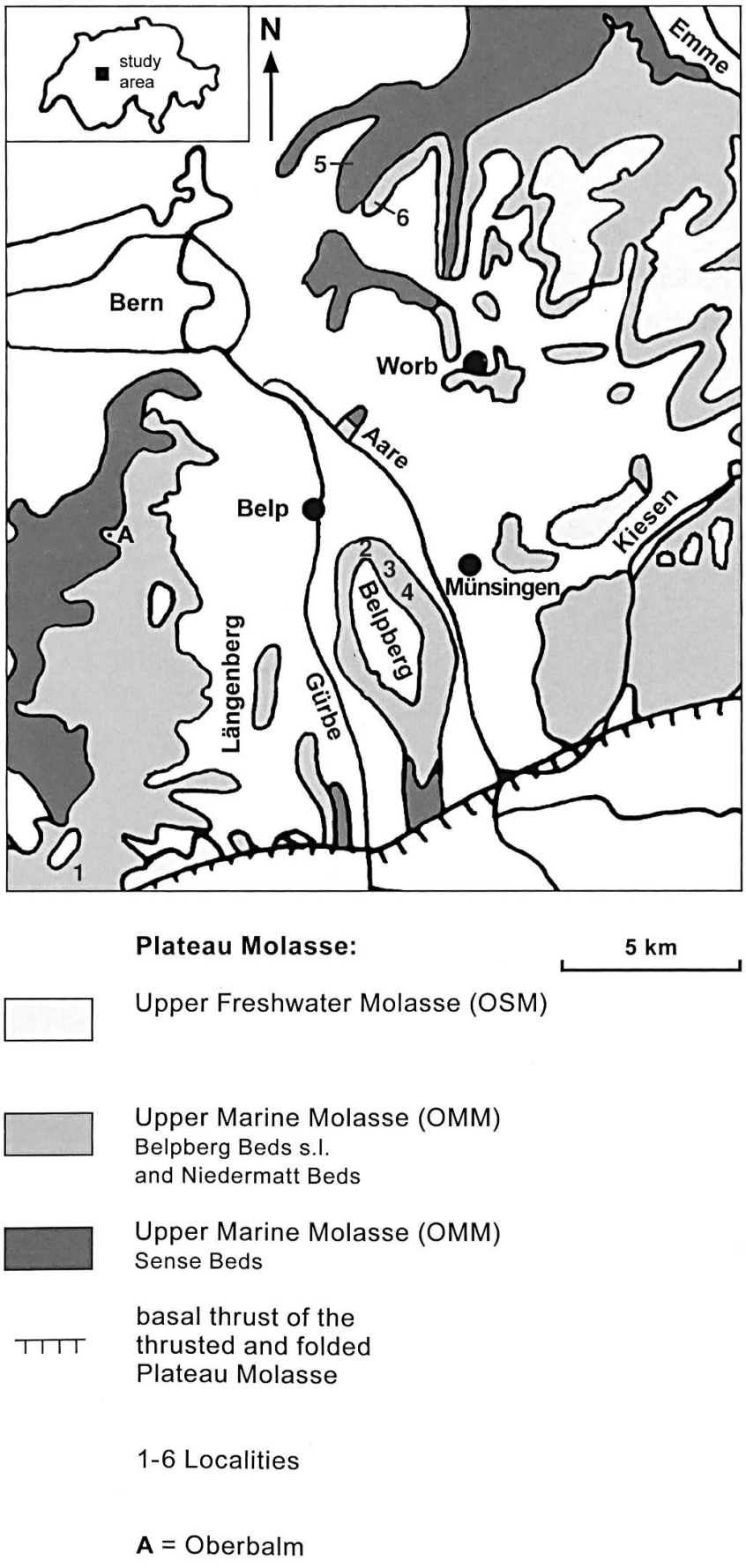

Fig. 1: Simplified geological map of the study area, indicating the different localities which yielded the Balanoidea described herein: – 1: Kräjeren near Rüschegg; – 2: Hohburg/Hohburggraben (Belpberg); – 3: Aarwald (Belpberg); – 4: Cheergraben (Belpberg); – 5: Stockeren near Bolligen; – 6: Bantiger near Bolligen (modified after Pfister & Wegmüller 1994; Kellerhals & al. 1999).

prepared, precluding observation of the shell interior. The material is contained in the O. Hug, H. Haas, B. Hostettler and W. Bühler collections, and, in part, stems from excavations initiated by the NMBE at localities at the Belpberg, at the Bantiger and from Kräjeren near Rüschegg (Fig. 1).

Systematic part

Subclass Cirripedia Burmeister, 1834

Superorder Thoracica Darwin, 1854
Order Sessilia Lamarck, 1818
Suborder Balanomorpha Pilsbry, 1916

Superfamily Balanoidea Leach, 1817
Family Archaeobalanidae Newman & Ross, 1976

Subfamily Archaeobalaninae Newman & Ross, 1976

Diagnosis (after Buckeridge 1983: p. 82)
Wall of eight, six or four compartments; parietes solid or with single, uniform row of tubes; interlaminate figures simple; basis calcareous or membranous, when membranous, wall solid.

Genus *Actinobalanus* Moroni, 1967

Type species:
Balanus (Hesperibalanus?) actinomorphus Moroni Ruggieri, 1952, by original designation.

Plate 1

Fig. 1: *Actinobalanus* sp., NMBE A3230, Belpberg, Cheergraben, Belpberg Beds, Burdigalian, excavation NMBE 1983.
Fig. 2: *Actinobalanus* sp., NMBE B8639, Belpberg, Hohburggraben, Belpberg Beds, Burdigalian, B. Hostettler Colln.
Fig. 3: *Notomegabalanus* sp., NMBE B8553, Belpberg, Hohburggraben, Belpberg Beds, Burdigalian, B. Hostettler Colln.
Fig. 4: *Notomegabalanus* sp., NMBE D2981, Aarwald, Belpberg, Belpberg Beds, Burdigalian, B. Hostettler Colln.
Fig. 5: *Notomegabalanus* sp., NMBE D741, Rüschegg, Kräjeren, Belpberg Beds, Burdigalian, H. Haas Colln.
Scale bars: 1 cm.


1
2
B
A
3
4
5
A

Diagnosis (after Zullo & Perreault 1989: p. 2; within brackets are characters not observable in the material studied):

Parietes monolamellar, solid, smooth or costate; parietal ribs not denticulate; radii solid, narrow to broad, disparietal or paraparietal (fine striations present on sutural edges of *A. dolosus*); basis calcareous, tubiferous; [interior of scutum and tergum usually rugose; scutal adductor ridge present; no callus between scutal adductor and articular ridges; scutal depressor muscle pit absent or small and deep, without crests; tergal spur narrow to broad, short, usually acuminate, basally rounded or subtruncate, with spur fasciole].

Actinobalanus sp. (Pl. 1, Figs. 1, 2)

Occurrence:
Belpberg (Cheergraben and Hohburg), Canton of Bern, Switzerland.

Material:
NMBE A3230: a group of shells on an internal mould of a tapetid bivalve; NMBE B8689: another group of shells on a similar substrate. One of the shells retains opercular plates of which only the external side is visible, but poor preservation precludes assessment of taxonomic characters.

Measurements:
NMBE B8689 (Pl. 1, Fig. 2), opercular orifice diameter (rostro-carinal); specimen A: 2.6 mm; specimen B: 1.8 mm.

Description:
Wall small, low conical, white to light brown; parietes solid, externally ribbed on the upper part and costate on the lower; orifice wide, rhomboidal; radii narrow; basis round, calcareous, tubiferous. Opercular plates, preserved in a single specimen, adhere closely to matrix obscuring their internal features, their external surface being too eroded to be of use.

Family Balanidae Leach, 1817

Subfamily Concavinae Zullo, 1992

Diagnosis (after Pitombo 2004, p. 264; within brackets are characters not observable in the material studied):

Wall of six plates, generally large, tubiferous, with one row of tubes with or without transverse septa. Sutural edges of radii with prominent transverse teeth bearing denticles on lower sides only; inner face with longitudinal abutment near the margin of sheath; alae sometimes cleft; lateral margin of sheath extending over the adjacent ala. Basis tubiferous, multilayered (vesicular) at least marginally. [Scutum sometimes without radial striae, with a conspicuous adductor ridge. Tergum with spur showing an abrupt change in the direction of growth lines with furrow margins infolded, basal margin with weak depressor muscle crests limited to border. Second maxilla with anterior margin of distal lobe bearing smooth acuminate setae].

Genus *Chesaconcavus* Zullo, 1992

Diagnosis (after Carriol & Schneider 2008, p. 5; within brackets are characters not observable in the material studied):

Alar sutural edge bifid; [scuta externally striate, with tergal segment narrow, and lateral depressor ridge separated from adductor ridge; terga with simple apex].

Type species:
Balanus concavus chesapeakensis Pilsbry, 1916, by original designation.

Chesaconcavus gurlarnensis Carriol & Schneider, 2008 (Pl. 2, Figs. 2–4)

Chesaconcavus gurlarnensis Carriol & Schneider (2008): p. 5, pls. 3, 4

Additional synonymy:
Balanus miser Lamarck, 1818 and *Balanus pustularis* Lamarck, 1818; Wineberger (1851): p. 87 (list of species).
Balanus concavus Bronn, 1831; De Alessandri (1910): p. 121 (in part; not small form), pl. 48, figs. 2–7 (non 8).

Occurrence:
Burdigalian: Gurlarn (type locality), near Passau (Lower Bavaria, southern Germany); Eggenburg region (Lower Austria); Stockeren, Bantiger and ?Belpberg, Canton of Bern (Switzerland).

Material:
NMBE A1801: one shell; NMBE D2972: a group of three shells; NMBE A7986: a group of shells; NMBE D2973: two shells; NMBE D2974: two shells; NMBE D2975: a group of shells.

Measurements:
NMBE D2972 (Pl. 2, Fig. 3), rostral height: specimen A: 48.9 mm.
NMBE D2974 (Pl. 2, Fig. 2), carinal height: specimen A: 65.9 mm.

Description:
Shell high conical, moderately large, parietes beige, externally smooth; orifice large, subtrigonal; radii solid, with very oblique summits; alae with sutural edges bifid and with lateral margins of sheath extending over the alae; sheath with clearly visible growth ridges, and occupying upper one-third to one-half of interior of shell wall; parietal tubes bearing closely spaced transverse septa in upper third; longitudinal primary parietal septa denticulate at their base; basis bearing a single row of septate tubes, multilayered marginally. Scuta and terga not preserved.

Discussion:
In the absence of opercular plates the specific attribution of these shells of *Chesaconcavus* is based on the resemblance with those of *C. gurlarnensis* from the Upper Burdigalian Upper Marine Molasse of Lower Bavaria, southern Germany.

Plate 2

Fig. 1: *Megabalanus* sp., NMBE A1800, Stockeren, Sense Beds, Burdigalian.
Fig. 2: *Chesaconcavus gurlarnensis*, NMBE D2974, Stockeren, Sense Beds, Burdigalian.
Fig. 3: *Chesaconcavus gurlarnensis*, NMBE D2972, Bantiger, Belpberg Beds, Burdigalian.
Fig. 4: *Chesaconcavus gurlarnensis*, NMBE A1801, Stockeren, Sense Beds, Burdigalian.
Scale bar: 1 cm.


A
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A
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Subfamily Megabalaninae NEWMAN, 1979

Diagnosis (after Pitombo 2004, p. 265; within brackets are characters not observable in the material studied):

Wall of six plates, generally large, wrinkled or lightly ribbed, tubiferous, with one major row of tubes lacking transverse septa in adults, except for *Megabalanus vinaceus* (DARWIN, 1854) and *Fosterella* BUCKERIDGE, 1983 which have minor tubes on inner and outer laminae, respectively. Radii tubiferous, sutural edges with prominent transverse septa bearing denticles on upper and lower side, or on lower side only; inner face with a longitudinal abutment near the sheath margin. Ala not cleft; lateral margin of sheath extending over the adjacent ala. Basis tubiferous, commonly multilayered (vesicular). [Scutum normally with a conspicuous adductor ridge. Tergum with spur showing an abrupt change in the direction of growth lines with furrow margins infolded, basal margin with weak depressor muscle crests limited to border. Second maxilla with anterior margin of distal lobe bearing smooth acuminate setae].

Genus *Megabalanus* HOEK, 1913

Diagnosis (emended after Carriol 2005, p. 123; within brackets are characters not observable in the material studied):

Parietes with one row of tubes; primary denticles of sutural edges of radii with regular secondary denticles on both upper and lower sides; basis generally tubiferous. [Tergum usually without beak].

Type species:
Lepas tintinnabulum LINNÉ, 1758, by original designation.

Megabalanus sp. (Pl. 2, Fig. 1)

Occurrence:
Stockeren, Canton of Bern, Switzerland.

Material:
NMBE A1800: a group of shells.

Measurements:
NMBE A1800 (Pl. 2, Fig. 1), rostral height: specimen A: 29.2 mm.

Description:
Wall tubuloconical, white to cream coloured, with smooth surface; radii wide with horizontal summits; sutural edges of radii with well-developed primary denticles bearing secondary denticles on upper and lower sides; parietes penetrated by longitudinal pores; basis with radiating tubes. Scuta and terga not preserved.

Genus *Notomegabalanus* Newman, 1979

Diagnosis (after Carriol 2002, p. 2; within brackets are characters not observable in the material studied):

Parietes with one row of tubes, sutural edges of radii with irregular secondary denticles on lower side only. [Tergum without beak and spur furrow open].

Type species:
Balanus decorus Darwin, 1854, by original designation.

Notomegabalanus sp. (Pl. 1, Figs. 3–5)

Occurrence:
?Belpberg, Belpberg (Aarwald, Hohburg, Hohburggraben, Cheergraben) and Rüschegg (Kräjeren), Canton of Bern, Switzerland.

Material:
NMBE A2978: two shells; NMBE A2979: one shell; NMBE A3181: a group of shells; NMBEA 3182: one shell; NMBE A3183: fragment of shell; NMBE B7913: a group of shells; NMBE B8552: a group of three shells; NMBE B8553: one shell; NMBE B8554: two shells; NMBE B8555: one shell on the internal mould of a gastropod; NMBE D741: a group of shells; NMBE D2976: a group of shells; NMBE D2977: one shell attached to an oyster shell; NMBE D2978: a group of shells; NMBE D2979: one shell; NMBE D2980: a group of three shells on an internal mould of a gastropod; NMBE D2981: one shell; NMBE D2982: a group of shells; NMBE D2983: one shell; NMBE D2984: one shell; NMBE D2985: a group of shells.

Measurements:
NMBE D741 (Pl. 1, Fig. 5), rostral height: specimen A: 13.9 mm; opercular ori-

fice diameter (rostro-carinal): 10.0 mm. NMBE B8553, rostral height: 14.7 mm; carinal height: 12.0 mm; opercular orifice diameter (rostro-carinal): 10.0 mm.

Description:
Wall high conical, with smooth surface, red brown to light brown, parietes with longitudinal darker stripes, penetrated by longitudinal pores; orifice small, subdiamond-shaped; radii and alae rather wide, with horizontal summits; sutural edges of radii with well-developed primary denticles bearing secondary denticles on lower side only; basis with radiating tubes. Scuta and terga not preserved.

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