Brief report

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The sexual dimorphism in the Tithonian, Jurassic, simoceratid ammonite *Lytogyroceras*

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The family Simoceratidae Spath, 1925, lumps various forms belonging to lineages with different roots and is clearly paraphyletic. One of its genera is *Lytogyroceras* Spath, 1924, which stands apart from the typical forms of the family bearing strong ribbing and tubercles. The sexual dimorphism of *Lytogyroceras* was supposed to be based only on adult size differences. Here we describe a recently collected lappeted microconch of *Lytogyroceras subbeticum* (Olóriz, 1978) from the Ponti Zone of Carchelejo (southern Spain). This microconch shows that the sexual dimorphism in the genus *Lytogyroceras* is not only characterized by different adult size of the sexes as formerly assumed, but also by different adult peristome morphology.

Introduction

The family Simoceratidae Spath, 1924, is paraphyletic and lumps various forms belonging to lineages of different origins (Enay and Howarth 2019). One of these genera that stands apart from the typical forms of the family bearing strong ribbing and tubercles, is *Lytogyroceras* Spath, 1925. The type species of this genus, by original designation, is *Ammonites fasciatus* Quenstedt, 1848, of which the holotype is refigured herein (Fig. 1A). The holotype is a macroconch, interpreted as a phragmocone with part of the body-chamber possibly preserved according to the large size relative to the microconch described below. The genus *Lytogyroceras* groups compressed evolute forms, strongly constricted, with ribbed inner whorls that become smooth up to the body-chamber; some doubtful cases with strong lateral and fine ventral ribbing in the adult whorls have been reported by Sarti (2020). The distribution and age of the genus are summarized in Enay and Howarth (2019), but the geographic distribution is larger than reported there (i.e., SE France, S Alps, Italy, Poland, and Hungary), including also Spain (e.g., Enay and Geyssant 1975; Olóriz 1978, Seyfried 1979), Germany—with a single record from a section near Ruhpolding in the Northern Calcareous Alps (Berger 2015), and an isolated record from Japan (Sato et al. 2008).

Sexual dimorphism of *Lytogyroceras* was supposed by Enay and Howarth (2019) to be based only on adult size differences. Nannarone and Bilotta (2021: 211, fig. 8a) suggested a tentative idealized reconstruction of the peristome with a small lappet and a rostrum. However, a recent collection of ammonites by one of the authors (ERA) from Carchelejo, southern Spain (see Parent et al. 2023), includes a perfect microconchiate specimen of *Lytogyroceras subbeticum* (Olóriz, 1978), with well-developed lappets (Fig. 1B). The specimen was collected loose in a scree, in the area where beds assignable to the Ponti–Jacobi zones crop out. The known stratigraphic range of *Lytogyroceras* is the Fallauxi to Ponti zones (Énay and Howarth 2019). In the collection from Carchelejo adult macroconchs occur frequently in the Ponti Zone, but the species was never collected from the overlying levels of the section. Thus, considering this information it can be assessed that the specimen most likely comes from the Ponti Zone.

The lectotype of *L. subbeticum*, designated by Cecca (2002: 369), is the specimen figured by Olóriz (1978: pl. 19: 2) from the Ponti Zone. *Lytogyroceras subbeticum* is very likely a junior synonym of *L. fasciatum* because of the identity of the outer whorls, but since the inner whorls of the holotype of the latter are not preserved (Fig. 1A), a more complete study is needed to ascertain this synonymy. Moreover, *L. fasciatum* (Quenstedt, 1848) itself is considered a junior subjective synonym of *L. strictum* (Catullo, 1846) (e.g., Zittel 1870; Olóriz 1978; Főzy 1988; Főzy et al. 2022).

Institutional abbreviations.—GPIT, Tübingen University, Germany; SMNS, Staatliches Museum für Naturkunde, Stuttgart, Germany.

Description of the microconch of *Lytogyroceras subbeticum*

The specimen (Fig. 1B) has a maximum diameter at peristome of 60 mm. The whorls have a subrectangular (juvenile) to ovate (adult), higher than wide section. The inner whorls are densely ribbed with slightly prosocline, undivided primaries. This ribbing fades gently from about 15 mm in diameter to almost smooth, only showing inconstant mild umbilical swellings and prosocline narrow constrictions. The last septum is at a diameter of 38 mm. The angular lenght of the body-chamber is 280°. After a radial constriction the lappets project in the upper half of the flanks. These are subtriangular, wide at the base, and moderately long (and the tip seems to be broken off). The specimen is an adult as the incipient uncoiling and lappets definitely indicate the end of growth.

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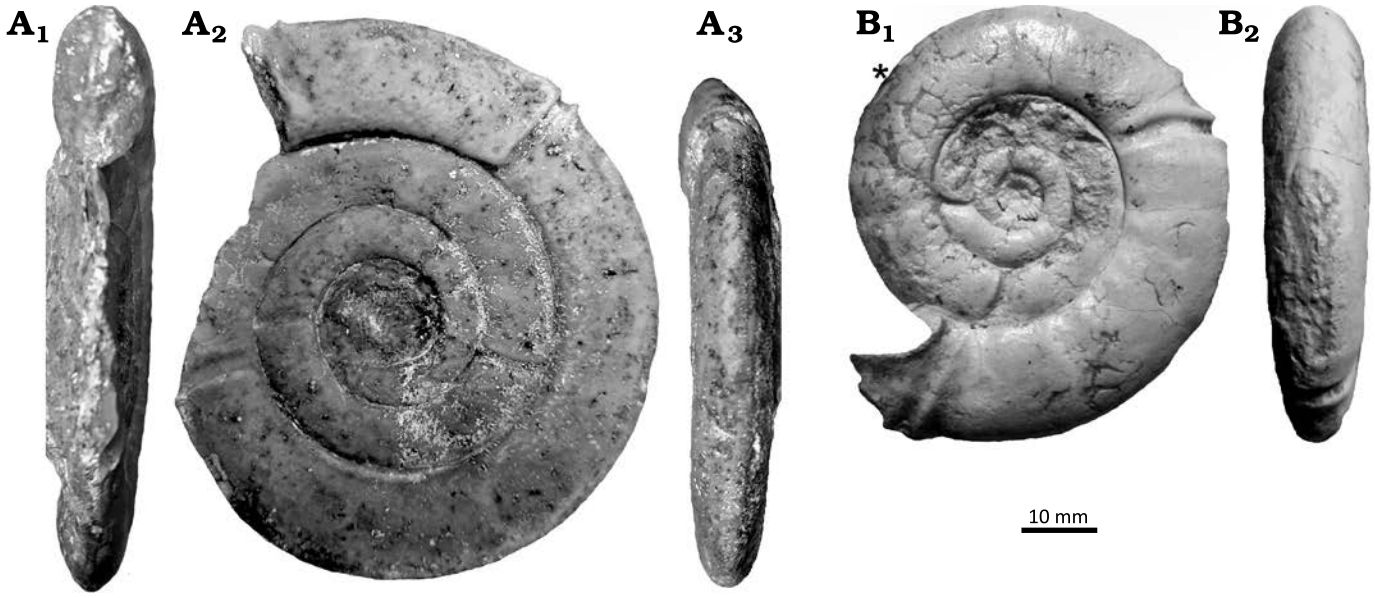

Fig. 1. Simoceratid ammonites of the genus *Lytogyroceras*. **A**. *Lytogyceras fasciatus* (Quenstedt, 1848), holotype (GPIT-PV-50085), from the Tithonian of Rovereto, NE of Lake Garda, Italy, interpreted herein as macroconch (female). **B**. *Lytogyroceras subbeticum* Olóriz, 1978, (SMNS-70695) from the Ponti–lower Microcanthum zones of Carchelejo, southern Spain, interpreted herein as complete adult microconch (male). Both species might be conspecific but it needs further work. Figure designed to represent natural size of the specimens. The asterisk indicates the last septum.

The sexual dimorphism in *Lytogyroceras*

The identity of the inner whorls of contemporaneous ammonites which only differentiate in large and smaller morphs, with characteristic morphologies, from a critical (but variable) diameter, is the strongest argument for their association as sexual dimorphs of a single species (e.g., Makowski 1962; Callomon 1963; see review in Klug et al. 2015). The establishment of sexual dimorphic pairs may produce different kinds of systematic, taxonomic, and/or nomenclatural changes (e.g., Maeda 1993; Parent and Zatoń 2016), or, like in the present case, it may consist of the simple first description of the microconch of a well-known species.

The microconch (male) of *Lytogyroceras subbeticum* described above shows that the sexual dimorphism in the genus *Lytogyroceras* is not only based on adult size differences between sexes as formerly supposed (Énay and Howarth 2019), but the microconchiate males bear well-developed lappets, as typical but not exclusive in the superfamily Perisphinctoidea.

All the nominal species of the genus *Lytogyroceras* are based on macroconch (female) specimens. The typical morphology, ornamentation and adult size of the adult macroconchs of *Lytogyroceras* are very well-characterized by the specimens from the Fallauxi Zone of Lókút Hill (Hungary) figured by Vígh (1984: pl. 3: 1–2). They are larger than our microconch and show a sigmoidal peristome, slightly expanded; the angular lenght of the body-chamber is about 330°.

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