

First record of the Tethyan ammonite genus *Canavarites* HYATT in the Lower Sinemurian of Germany, with description of a new species

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Abstract

A single specimen of the Tethyan ammonite genus *Canavarites* is recorded from the Lower Sinemurian Arietenkalk Formation of south-western Germany. The specimen was found in a limestone bed in which *Vermiceras scylla* (REYNÈS) is the predominant ammonite species. Thus, the finding horizon most likely corresponds to the British *Vermiceras scylla* biohorizon which lies at the base of the Bucklandi Subzone. A new species, *Canavarites meisteri* n. sp., is introduced for the specimen from Swabia. It is the first unequivocal record of this rare genus besides the type localities of the two other *Canavarites* species near La Spezia in Italy.

Key words: Ammonites, Arietitidae, biostratigraphy, palaeobiogeography.

Zusammenfassung

Ein Einzelstück der tethyalen Ammonitengattung *Canavarites* wird aus der Arietenkalk-Formation des Unter-Sinemuriums in Südwestdeutschland vorgestellt. Es stammt aus einer Kalkbank, in der die Ammonitenart *Vermiceras scylla* (REYNÈS) vorherrscht. Daher dürfte der Fundhorizont dem britischen Biohorizont des *Vermiceras scylla* an der Basis der Bucklandi-Subzone entsprechen. Für das Stück aus Schwaben wird eine neue Art, *Canavarites meisteri* n. sp., eingeführt. Sie stellt den ersten unzweifelhaften Nachweis dieser seltenen Gattung außerhalb der Typuslokalitäten der beiden anderen *Canavarites*-Arten bei La Spezia in Italien dar.

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1. Introduction

The Lower Sinemurian Arietenkalk Formation of south-western Germany is famous for its large-sized ammonites of the Family Arietitidae, which often occur in mass accumulations on bedding planes of dark grey limestones (“Schneckenpflaster”). The bulk of ammonite species from these beds was described in the 19th century in the classical monographs by QUENSTEDT (1856, 1882–1885) and OPPEL (1862). SCHLEGELMILCH (1976) provided a compilation of numerous type specimens and further ammonites from the Swabia Lower Jurassic and thus is a good source for an overview on the occurring taxa. Despite this long history of sampling and the richness in fossils it is a fact that the knowledge on the NW-European Early Sinemurian ammonite faunas is focused on the large-sized, conspicuous taxa, whereas small-sized forms or microconchs have been widely neglected or just regarded as nuclei of the larger ones. The lithological succession and the ammonite content of the Arietenkalk Formation were stratigraphically analyzed by WALLISER (1956a, b). URLICH (1977) gave a brief compilation of the stratigraphical succession of the whole Lower Jurassic in Swabia, with

several sections showing the ranges of selected ammonite taxa. However, a high-resolution biostratigraphical analysis of the Arietenkalk Formation, comparable to that in France or Great Britain (e. g., CORNA 1987; CORNA et al. 1997; PAGE 2003, 2010), is still missing for this classical area of Jurassic research. Until the middle of the 20th century numerous small quarries existed, where the Lower Jurassic limestones were exploited for local road building and similar purposes. Meanwhile, however, all of them are closed and no longer accessible, so that all new research activities depend on temporary outcrops.

Recently, parts of the Arietenkalk Formation were exposed in conduit trenches of an industrial area in the northwestern margin of the village of Aldingen, in the foreland of the western Swabian Alb (Fig. 1). Within the excavated material, a dark grey limestone bed with a thickness of ca. 20 cm was very rich in fossils. In regional lithostratigraphic terms this bed is called “Dreispälder”, a name introduced by the quarrymen in this area. The quarrymen’s name of this bed means that it can be split into three thinner parts. The fauna of this bed consists of numerous bivalves (predominantly *Gryphaea arcuata*), nautiloids (*Cenoceras striatum*), brachiopods (*Spiriferina*

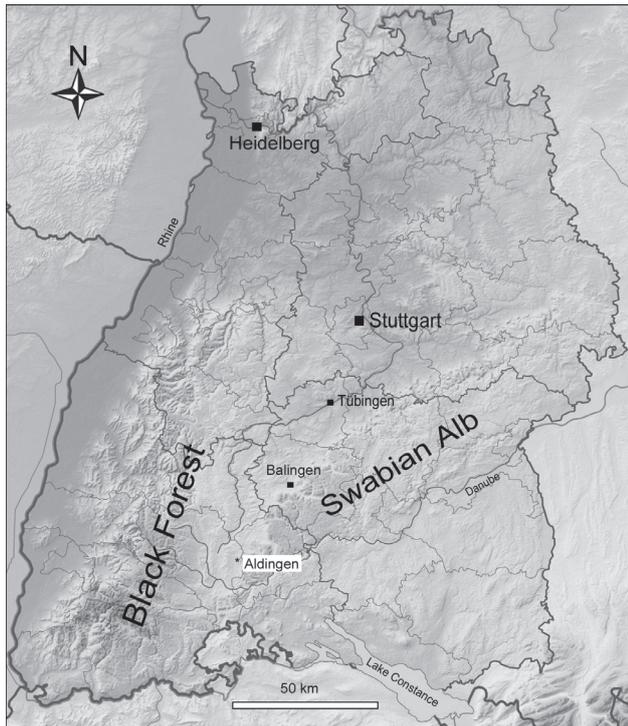


Fig. 1. The finding place of *Canavarites* (asterisk) in the southwestern part of Baden-Württemberg, SW Germany (modified version based on http://de.wikipedia.org/wiki/Datei:Baden-Wuerttemberg_relief_location_map.jpg; GNU Free Documentation License, version 1.2).

walcotti) and ammonites. Among the observed ammonites mostly belonging to *Vermiceras*, a minute but unusual ammonite was discovered. This ammonite, associated with many specimens of *Vermiceras scylla*, comes from the lower third of the excavated bed. We here like to document this rare find which belongs to a genus previously unknown from the Swabian Jurassic.

The specimens illustrated in this study are housed in the collection of the Staatliches Museum für Naturkunde Stuttgart (acronym SMNS).

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2. Systematic palaeontology

Family Arietitidae HYATT, 1875

? Subfamily Pseudotropitinae DONOVAN, 1973

Genus *Canavarites* HYATT, 1900

Remarks. – The genus *Canavarites* was introduced by HYATT (1900) without any further discussion and originally included in Amaltheidae. In the (still unrevised) 'Treatise' volume, ARKELL (1957) included *Canavarites* in Alsatitinae SPATH, 1924, together with several other exotic genera such as *Pseudotropites* WAEHNER, 1894, *Tmaegoceras* HYATT, 1889, or *Hyperifalchia* FUCINI, 1907. The type species of this genus and its taxonomic and nomenclatorial history was later discussed by DONOVAN & FORSEY (1973). DONOVAN et al. (1981) still kept *Canavarites* in Alsatitinae. GUÉRIN-FRANIATTE (1994, fig. 1) interpreted the "exotic" genera *Canavarites*, *Pseudotropites* and *Tmaegoceras* as offshoots of Arietitidae without any closer relationship to *Alsatites*. In our view, the ribbing style and the inflated, involute shell morphology of *Canavarites* causes serious doubts about a placement in Alsatitinae, which contains in the nominal genus taxa with exclusively serpenticonic shells. The current definition of this family appears purely artificial and not substantial in modern terms of phylogenetic relationship (DONOVAN & FORSEY 1973). An alternative possibility not yet proposed would be the inclusion of *Canavarites*, *Pseudotropites* and – with some reservation – *Tmaegoceras* in Pseudotropitinae DONOVAN, 1973. DONOVAN (in DONOVAN & FORSEY 1973) originally defined Pseudotropitinae as Arietitidae with depressed whorls characterized by the appearance of secondary ribs arising from spines at the end of the primaries. Perhaps this definition was too limited and has to be emended. The suture lines of *Canavarites* and *Pseudotropites* are very close. In *Tmaegoceras* the suture lines of different observed specimens (material studied by GEBHARD & SCHLATTER 1977) show remarkable individual differences. Nevertheless, more material is needed to confirm or reject this tentative placement suggested here.

Included species: *Canavarites discretus* HYATT, 1900 (= *Arietites discretum* (SOWERBY) in CANAVARI 1882); *Arietites campigliensis* CANAVARI, 1882; *Canavarites meisteri* n. sp. (herein).

Canavarites meisteri n. sp.

Fig. 2

Etymology: The trivial name honours Dr. CHRISTIAN MEISTER (Genève), renowned expert in Early Jurassic ammonites, who has drawn our attention to the exotic genus *Canavarites*.

Holotype: Specimen illustrated on Fig. 2, SMNS 67852.



Fig. 2. *Canavarites meisteri* n. sp., holotype, in lateral and ventral view. Arietenkalk Formation, „Dreispäler“ Bed, Aldingen near Spaichingen, SW Germany, from the industrial area of the village in the direction to Aixheim. SMNS 67852. – Asterisk marks approximate end of phragmocone; scale equals 1 cm.

Type locality: Aldingen near Spaichingen, SW Germany (Fig. 1).

Type horizon: Arietenkalk Formation, “Dreispäler” bed (= second limestone bed of the Arietenkalk Formation; Lower Sinemurian, Bucklandi Zone/-Subzone, for details of age see below).

Measurements: Diameter: 19 mm; whorl height: 7.3 mm; whorl width: 10 mm; umbilical width: 5.8 mm; 21 ribs on last half whorl.

Diagnosis. – Dense and fine-ribbed species of *Canavarites* in which the ribs are forwardly curved on the broad, keeled venter, not strictly radial as in the other species of the genus.

Description. – The holotype is an uncompressed mould with calcitic remains of the test, especially in the inner whorls. Suture lines are not well observable but at least the last half of the outer whorl belongs to the body chamber. The aperture is not preserved. In the first third of the body chamber the shell is ventrally injured, probably by the activity of a predator (KLOMPMAKER et al. 2009). The coiling is moderately involute, with a depressed, broad-oval whorl section. The umbilical wall is rounded. The sculpture of the innermost whorls seems almost smooth, apart from growth lines, and then changes to prorsiradiate, flexuous, rather densely spaced ribs which are strongly projecting towards the keel. In two positions of the body chamber, the inclination of the ribs changes and pseudo-bifurcations occur. The ribs fade out before reaching the keel, which is smooth and not accompanied by lateral sulci.

Comparisons. – In lateral view *Canavarites meisteri* n. sp. resembles *C. campigliense* (CANAVARI) (see Fig. 3 top), however, the ribs in *C. campigliense* approach the median keel in a strongly perpendicular style, whereas they are forwardly curved in *C. meisteri* n. sp. *C. campigliense* exhibits a slightly larger width and a less dense

ribbing. *C. discretus* is the coarsest ribbed species of the genus (see Fig. 3 bottom). Although these differences allow a distinction at the species level, all taxa seem closely related and possibly part of a chronocline, which remains nebulous due to the incompleteness of finds. At present we know almost nothing about intraspecific variation since both *C. campigliense* and *C. meisteri* n. sp. are monotypic. In the case of *C. discretus*, CANAVARI (1882, 1888) illustrated three very similar specimens from the same locality. In ventral view, *C. meisteri* n. sp. shows some remarkable resemblance with a specimen of *Pseudotropites ultratriasicus* (CANAVARI) illustrated from the Hettangian/Sinemurian boundary beds of Nevada (TAYLOR 2000, pl. 3, figs. 7–8). The occurrence of bipartite ribs with a spinose bifurcation point distinguishes *Pseudotropites* from *Canavarites*, but a close common origin of both genera appears conceivable.

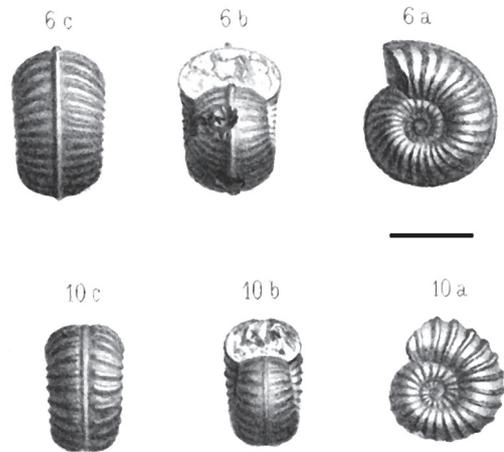


Fig. 3. *Canavarites campigliense* (CANAVARI) [fig. 6] and *Canavarites discretus* HYATT [fig. 10] from the Lower Liassic of Campiglia and Coregna respectively, near La Spezia, Italy (reproduction from CANAVARI 1882). – Scale equals 1 cm.

3. Biostratigraphical implications

WALLISER (1956a, b) studied several sections in the Arietenkalk Formation along the Swabian Alb, among them a section in a small quarry in Aldingen (“Gemeindesteinbruch”). As many of these quarries, this one is abandoned and meanwhile no longer accessible. The so-called Dreispäler is a bed which WALLISER assigned to his “Zone II”. Unfortunately he did not provide a detailed description of this section together with related biostratigraphical data of the ammonites. In the comments to the geological map of this area (BERZ 1936) the former quarry in Aldingen is mentioned as being rich in fossils, but no section is given either.

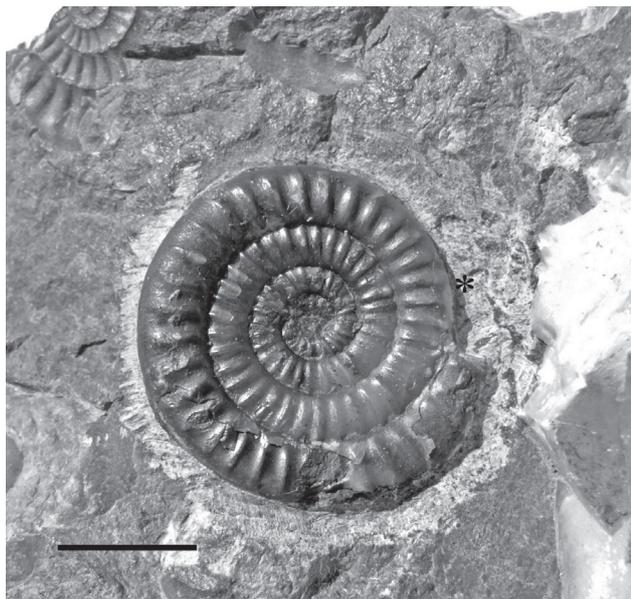


Fig. 4. *Vermiceras scylla* (REYNÈS). Same bed and locality as Fig. 2. SMNS 67853. – Asterisk marks end of phragmocone; scale equals 1 cm.

A further ammonite species of Tethyan origin coming from probably the same or a closely allied stratigraphical level within the Arietenkalk Formation is *Angulaticeras ventricosum* (SOWERBY), of which BLOOS (1979, fig. 1.4) has illustrated an example from the “Dreispälder” bed of Balingen-Endingen. Like in *Canavarites discretum* and *C. campigliense*, the type locality of this species is in the vicinity of La Spezia in Italy (CANAVARI 1882, 1888).

Another Tethyan ammonite genus, *Tmaegoceras* HYATT, has been recorded from the Arietenkalk Formation of Aldingen (GEBHARD & SCHLATTER 1977, pl. 1, fig. 3). The exact bed from which this specimen comes is unknown. According to its preservation and matrix it is possible that it comes from the same bed as the *Canavarites*. A further published specimen of *Tmaegoceras crassiceps* POMPECKJ, however, comes from a younger bed in the top of the Bucklandi Subzone (GEBHARD & SCHLATTER 1977, fig. 1). In the vicinity of Balingen, the latter bed has meanwhile supplied several further specimens of *Tmaegoceras* (pers. comm. N. WANNENMACHER, Thanheim) thus indicating a Tethyan immigration event.

For a precise biostratigraphical interpretation of the bed which yielded *Canavarites meisteri* n. sp., the co-occurring *Vermiceras scylla* (REYNÈS) is crucial. In the “Dreispälder” Bed at Aldingen, this species of REYNÈS (1879), revised by DONOVAN (1955), is extremely common. It seems obvious that WALLISER (1956a: 194) has misidentified this species in the section of Aldingen as *Vermiceras spiratissimum* (QUENSTEDT), whereas FIEGE (1929, pl. 3, figs. 1–2) correctly identified *Vermiceras scylla* in a nearby

section at Neuhaus. The abundant material from Aldingen of which we illustrate a typical example (Fig. 4) lacks a bisulcate venter, so that there is no doubt about its identity. In southern France *Vermiceras scylla* is very characteristic for the “horizon à Coronaries” at the base of the Bucklandi Subzone (CORNA 1987). In Great Britain, *Vermiceras scylla* was chosen as the index of a “*scylla* biohorizon” at the base of the Bucklandi Subzone (PAGE 2003). Hence, we can state that an equivalent of this *scylla* biohorizon is the type horizon of *Canavarites meisteri* n. sp., and the base of the Bucklandi Subzone is located within the “Dreispälder” Bed of the Arietenkalk Formation.

4. Palaeobiogeographic implications

Hitherto, the only record of *Canavarites* mentioned in literature apart from the type locality in the Lower Liassic of La Spezia (Italy) is in the Lower Sinemurian of Lorraine, eastern France (GUÉRIN-FRANIATTE 1990, 1994). However, the small nuclei illustrated in her monograph do not exhibit a keeled venter or any other unequivocal characters which would support an assignment to *Canavarites*. In accordance with G. BLOOS (pers. comm.) we interpret these questionable records as indeterminable nuclei of other Arietitidae. Hence, our single specimen from south-western Germany remains the worldwide sole further record besides those from Italy, and the first one collected with precise stratigraphical information. The occurrence of *Canavarites* at the base of the Bucklandi Subzone of the Swabian Lower Jurassic indicates immigration from the Tethys. Probably the lacking record of *Canavarites* spp. in other well-studied Tethyan areas such as the Northern Calcareous Alps has multiple reasons. The small-sized specimens can be easily overlooked, and the predominant occurrence of red nodular limestones in the Alpine Sinemurian hampers the preservation of small ammonites in general.

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