Studia breviora

On the “*Macrocephalites macrocephalus*” Zone of the lower Callovian in NW Bulgaria

Callovian strata in Bulgaria largely correspond to fine carbonate-mudstone, pelagic to hemipelagic sediments, in which ammonites are unevenly distributed and rarely compose continuous successions. In wide areas, the Callovian rocks provide an incomplete record, resulting from regional events of submarine erosion and non-deposition. The majority of the Callovian ammonite fields known to date also have the disadvantage of being often thinly developed or condensed into a few tens of centimetres of rock. Almost every single locality exhibits a different composition and state of preservation. Only a few areas in NW Bulgaria contain a limited number of attractive Callovian outcrops where ammonites are good enough so that a reference set of faunal horizons could be defined. These circumstances have resulted in Bulgarian Callovian ammonites being inadequately studied to date. Good Bulgarian Callovian ammonite faunas have been recorded in the past from a limited number of localities (*e.g.*, Bončev and Popov, 1935; Sacharjeva-Kowatcheva, 1956; Sapunov and Nachev, 1959; Tzankov *et al.*, 1960; Stephanov, 1961), almost all of which have now disappeared. A few collections of Callovian ammonites have recently been made from several exposures west of the Iskar River Gorge, from the Belogradchik region, as well as from the good Jurassic section at the Nechinska Bara River Valley (see Fig. 1).

Hitherto, the state of knowledge has allowed subdividing the Callovian into three ammonite zones, corresponding to its substages. These broad zones have remained without appropriate indices and with poorly defined stratigraphy and limits to date. It should be noted that, since the times of discovery and the tentative subdivision of the Callovian in Bulgaria, only *Macrocephalites* have been considered to be the age-diagnostic ammonites of the early Callovian. It was previously accepted that the widest occurrence and the highest abundance

amongst the *Macrocephalites* faunas is that of *Macrocephalites macrocephalus* (Schlotheim), thus it had long been used as index-species of the *M. macrocephalus* Zone, which completely matches the extent of the lower Callovian. In our view, however, the bulk of the examples previously thought to be *M. macrocephalus* (*i.e.*, Bončev and Popov, 1935; Sapunov and Nachev, 1959; Stephanov, 1961) have been interpreted too widely. Moreover, following the revisions of *M. macrocephalus* (Schlotheim) by Callomon (1971) and Callomon *et al.* (1992), it is probable that a few, if any, of the Bulgarian specimens can be attributed to this species. As stated by Callomon *et al.* (1992), many names (mostly at subgeneric level) have received a wide currency in the literature, trying to systematize the wide variety

Fig. 1. Outline of Bulgaria with the area containing the main fields of lower Callovian ammonites (a), and sketch map of the Jurassic outcrops and the localities taken into account in this study (b). The localities are marked by a red circle and a number: 1 – Granitovo; 2 – Belogradchik–Gara Oreshets; 3 – Dolni Lom; 4 – Nechinska Bara; 5 – Komshtitsa; 6 – Gubesh; 7 – Gintsi.

of morphologies that occur in all combinations of nearly every *Macrocephalites* assemblage known to date. Callomon *et al.* (1992) proposed a dimorphic classification of the valid (sub)generic names, but it seems that our faunas do not fit in it as the morphologies observed are often not in accordance with the dimorphic diagnoses given by these authors. Therefore, in this note, we refrain from subgeneric assignments. *Macrocephalites* will have to be reassessed in terms of both taxa and ranges, but we are convinced that *M. macrocephalus* does not have a significant role in the record of *Macrocephalites* faunas in Bulgaria. Only in a few cases are the *Macrocephalites*-bearing localities sufficiently plentiful

and providing enough well-preserved and stratigraphically controllable specimens to define important successions. However, we opine that a two-fold zonal subdivision of the lower Callovian, based on *Macrocephalites* species, is possible and seems to be workable: the *Macrocephalites herveyi* Zone and the *Macrocephalites gracilis* Zone. In this way, the older *M. macrocephalus* Zone is redundant.

The *Macrocephalites herveyi* Zone is based on the occurrence of several earlier *Macrocephalites* species, including the index (see Fig. 2). The lower boundary is drawn by the appearance in abundance of *Macrocephalites*. We judge that the range of these species is as follows: *Macrocephalites jac-*

Fig. 2. Diagnostic ammonites for the lower Callovian *Macrocephalites herveyi* Zone: a) *Macrocephalites jacquoti* (Douvillé) [M], locality Komshtitsa, Bov Formation (Coll. GI-BAS, Inv.-Nr F.016081); b) *Macrocephalites subtrapezinus* (Waagen), locality Gintsi, Yavorets Formation (Coll. GI-BAS, Inv.-Nr F.016080); c) *Macrocephalites cf. herveyi* (Sowerby) [M], locality Gubesh, Bov Formation (Coll. GI-BAS, Inv.-Nr F.016082); d) *Macrocephalites versus* Buckman [M], locality Granitovo, Yavorets Formation (Coll. GI-BAS, Inv.-Nr F.016083); e) *Macrocephalites cf. dolius* (Buckman), from the same locality as b (Coll. GI-BAS, Inv.-Nr F.016084). All figures are in reduced size ($\times 0.6$).

quoti (Douvillé) → *M. transitorius* Spath, *M. versus* Buckman, *M. subtrapezinus* (Waagen), *M. dolius* (Buckman) → *M. herveyi* (Sowerby). This sequence is not readily demonstrable in Bulgaria, but, using specimens from different localities, it is possible to be confirmed. *Macrocephalites transitorius* and *M. versus* yielded the highest number of specimens, whereas the other species are less common. The diagnostic elements of the *M. herveyi* Zone are accompanied by almost no species other than rare examples of *Kheraicerias bullatus* (d'Orbigny) (Metodiev, 2019), single *Cadoceras elatmae* (Nikitin) [= *C. modiolare* (Luidius) sensu Sapunov and Nachev, 1959], and several *Homoeoplanulites* ex gr. *furculus* (Neumayr), *Homoeoplanulites demariae* (Parona and Bonarelli) and *Homoeoplanulites* aff. *subbackeriae* (d'Orbigny). Thus, there is no option to use another index and definition other than that based on *Macrocephalites*. At the same time, we do not extend the zonation beyond the Submediterranean Province, as the Bulgarian *M. herveyi* Zone and the *Bullatimorphites* (*Kheraicerias*) *bullatus* Zone of the zonal scheme for Southwest Europe and North Africa (Thierry *et al.*, 1997) are equivalents.

The *Macrocephalites gracilis* Zone covers the upper and greater part of more extended *Macrocephalites* occurrences in Bulgaria and corresponds to the long range of the index. The upper limit of the zone is placed by the disappearance of these faunas. A very rare occurrence of *Macrocephalites* upwards into the middle Callovian is possible but inadequate data exists in order to confirm the link between these occurrences and the main range of the genus. The index-species was founded earlier [= *Macrocephalites cannizzaro* (Gemmellaro) by Sapunov and Nachev, 1959], but without an accurate stratigraphical record and from a single locality from NW Bulgaria. A recent carefully controlled collection from the sequence at the Nechinska Bara River Valley has identified that *Macrocephalites gracilis* Spath has a well-developed vertical distribution. The latter consists of two morphological groups: 1) small and involute ammonites (probably microconchs), with high and compressed whorls, which are covered by thin and dense ribs, slightly prorsiradiate and branched in 2–3 long secondaries; 2) large specimens (macroconchs with simple and deeply carved back aperture) that often attain diameters more than 180 mm, and that have a wider umbilicus, stouter whorls, subdued and less dense ornament, which almost entirely disappears on the body chamber. It is clear that there is a wide variation in morphologies, on which we have determined this species. Perhaps, our understanding of *Macrocephalites gracilis* is too broad. Nevertheless, it is

certain that *M. gracilis* arises later and can easily be distinguished from the species that define the *M. herveyi* Zone below. Only in the lower parts of the *M. gracilis* Zone, we identified *Macrocephalites* faunas that are different from the index, and possibly belonging to other species: *Macrocephalites* ex gr. *liberalis-lophopleurus* (Buckman), *M. septifer* (Buckman), *M. lamellosus* (Sowerby), and *Macrocephalites* ex gr. *macrocephalus* (Schlotheim) (see Fig. 3).

The remaining diagnostic faunal elements of the *Macrocephalites gracilis* Zone include the occurrence of common and various pseudoperisphinctins (*Indosphinctes*, *Elatmites*, *Homoeoplanulites* and *Choffatia*), each of which yielded many examples of characteristic species. Coexisting with these faunas, but rarely encountered in this zone, and therefore thought to be accessory elements, are a few *Gowericeras* cf. *gowerianus* (Sowerby), *Catasigaloceras* spp., *Rehmannia* ex gr. *grossouvrei* (Petitclerc) and *Reineckeia* spp. Scarce oppeliids assigned to *Alcidia mamertensis* (Waagen) (Metodiev, 2019), *Thraxites davitashvili* (Stephanov), *T. thrax* (Stephanov), as well as poorly stratigraphically recorded *Eulunulites* ex gr. *lunula* (Reinecke), *Hecticoceras hecticum* (Reinecke), *Zieteniceras pseudolunula* (Elmi) and *Jeanneticeras* spp. have also been found. The stratigraphical relationships of these faunas still remain unclear, but it seems that they can be further arranged into a proper stratigraphical order.

A further subdivision of the *M. gracilis* Zone seems possible, but more specimens at most locations are necessary to draw our conclusion. The most valuable elements of the zonal association are *Indosphinctes* and *Elatmites*. The former group includes several distinctive and very well-represented species, e.g., *Indosphinctes patina* (Neumayr), *I. luecyensis* Mangold, *I. zelleri* (Petitclerc), *I. petaini* (Lemoine), *I. rusticus* Spath and *I. choffati* (Parona and Bonarelli). *Elatmites* represents the probable dimorphic counterpart of *Indosphinctes* and includes: *E. steinmanni* (Parona and Bonarelli), *E. revili* Mangold, *E. nikitinoensis* (Sazonov), *E. praheccuensis* Mangold, *E. cheyensis* (Petitclerc) and *E. calloviensis* (Loczy). Further relevant elements are those of *Homoeoplanulites* and *Choffatia*, such as *Homoeoplanulites furculus* (Neumayr), *H. difficilis* (Buckman), *H. funatus* (Oppel) and *H. madani* (Spath), as well as *Choffatia* ex gr. *perdagata* (Waagen), *C. recupeoi* (Gemmellaro), *Choffatia* ex gr. *transitoria* (Spath), *Choffatia* ex gr. *pseudofunata* (Teisseyre) and *C. cobra* (Waagen). Both *Indosphinctes*–*Elatmites* and *Homoeoplanulites*–*Choffatia* faunas deserve special attention, and their taxonomy and biostratigraphy will be discussed in detail elsewhere.

Fig. 3. Diagnostic ammonites for the lower Callovian *Macrocephalites gracilis* Zone: *a, b*) *Macrocephalites gracilis* Spath [M] and [m], section at the Nechinska Bara River Valley, Verenitsa Member of the Bov Formation (Coll. GI-BAS, Inv.-Nrs F.016085, F.016086); *c, d*) *Macrocephalites lamellosus* (Sowerby) [M], from the same section as *a, b* (Coll. GI-BAS, Inv.-Nrs F.016087, F.016088); *e, f*) *Macrocephalites septifer* (Buckman) [M] and [m], from the same section as *a, b* (Coll. GI-BAS, Inv.-Nrs F.016089, F.016090); *g*) *Macrocephalites* ex gr. *liberalis* (Buckman), from the same section as *a, b* (Coll. GI-BAS, Inv.-Nr F.016091); *h*) *Macrocephalites* ex gr. *lophopleurus* (Buckman), from the same section as *a, b* (Coll. GI-BAS, Inv.-Nr F.016092); *i*) *Macrocephalites* ex gr. *macrocephalus* (Schlotheim) [M], locality Belogradchik–Gara Oreshets, Yavorets Formation (Coll. GI-BAS, Inv.-Nr F.002854). All figures are in reduced size ($\times 0.4$).

The above stated considerations lead to the belief that the *Macrocephalites gracilis* Zone in Bulgaria corresponds to the *Macrocephalites* (*Dolikephalites*) *gracilis* Zones of the zonal scheme of Thierry *et al.* (1997) for Southwest Europe and North Africa (Submediterranean Province). Another conclu-

sion to be drawn from the above evidence is that at least valuable indications of the better-known lower Callovian Submediterranean ammonite faunal horizons are available. Therefore, deeper faunal subdivisions of the lower Callovian seem achievable. If we clarify the superposition of the *Macrocephalites*

species and accessory ammonites, from the lower parts of the *M. gracilis* Zone, it is possible to define *Macrocephalites*-based, subzonal equivalents of the Submediterranean subzones of Thierry *et al.* (1997), from the *Bullatimorphites* (*Bomburites*) *praehed-quense* Subzone to the *Rehmannia laugieri* Subzone. This is the only way we can follow, because, apart from *Macrocephalites*, there are no other diagnostic

faunas supporting this segment of the long range of *Macrocephalites gracilis*. Higher up, the *M. gracilis* Zone could be divided into more subzones, based on the occurrence of the rich *Indosphinctes*–*Elatmites* and *Homoeoplanulites*–*Choffatia* faunas, which would correspond to the *Hecticoceras* (*Chanasia*) *michalskii* and *Indosphinctes patina* subzones of the scheme of Thierry *et al.* (1997).

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