



Macroscale morphological features of Jurassic European coleorrhynchans (Hemiptera)

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The Hemiptera Linnaeus in 1758, is one of the “Big Five” of the most diverse orders of insects. Hemiptera first appeared in the Carboniferous period, approximately 315 million years ago, and has since undergone significant evolutionary changes, characterized by periods of both prolific speciation and mass extinctions (Handlirsch 1906, Szwedo 2011). The Jurassic period was one such time of evolutionary transformation, which ultimately led to the modern fauna of these insects. Jurassic palaeoentomofaunas in Europe, including Hemiptera, are crucial for understanding these evolutionary events; however, our knowledge of them is still limited. The Coleorrhyncha, are particularly well represented in European fossil deposits, though they have been insufficiently studied. Most specimens originate from deposits dating to the Toarcian Oceanic Anoxic Event (Kemp *et al.* 2022), a time when both terrestrial and marine biota underwent significant changes. The unique taphonomic conditions of this period resulted in a rich and well-preserved record of these insects (Ansorge 1996, 2003).

Material and Methods:

The analyzed specimens come from European Jurassic deposits — specifically Grimmer and Bascharge — which represent nearshore environments that facilitate the preservation of many insects (Ansorge 2003).

The Grimmer deposit contains a significant number of very well-preserved specimens, including aerial plankton. The percentage of insects is notably high and includes groups such as Coleoptera, Orthoptera, Heteroptera, Coleorrhyncha, Auchenorrhyncha, and a few Sternorrhyncha, suggesting a nearshore, terrestrial environment. Insects that lived near water could have been transported by rivers, winds, and during swarming and dispersal events. This deposit also includes marine fossils such as ammonites, teuthoideans, bivalves, fish, and marine reptiles.

Taphonomic and fossil diagenetic processes are the primary factors involved in the formation of insect taphocoenoses within these marine deposits (Ansorge 2003, 2007).

In contrast, insects from the Bascharge deposit are typically found as isolated wings or fragmentary material but are abundant in quantity. These include Odonata, Dictyoptera, Planipennia, Phasmatodea, Orthoptera, Hemiptera, Hymenoptera, Neuroptera, Coleoptera, Amphiesmenoptera, and Diptera (Ansorge 2003, Henrotay *et al.* 1998). Other fossils from this area include reptiles, fish, crustaceans, and higher plants. The diverse combination of organisms confirms the nearshore nature of this region (Hermoso 2014, Henrotay *et al.* 1998).

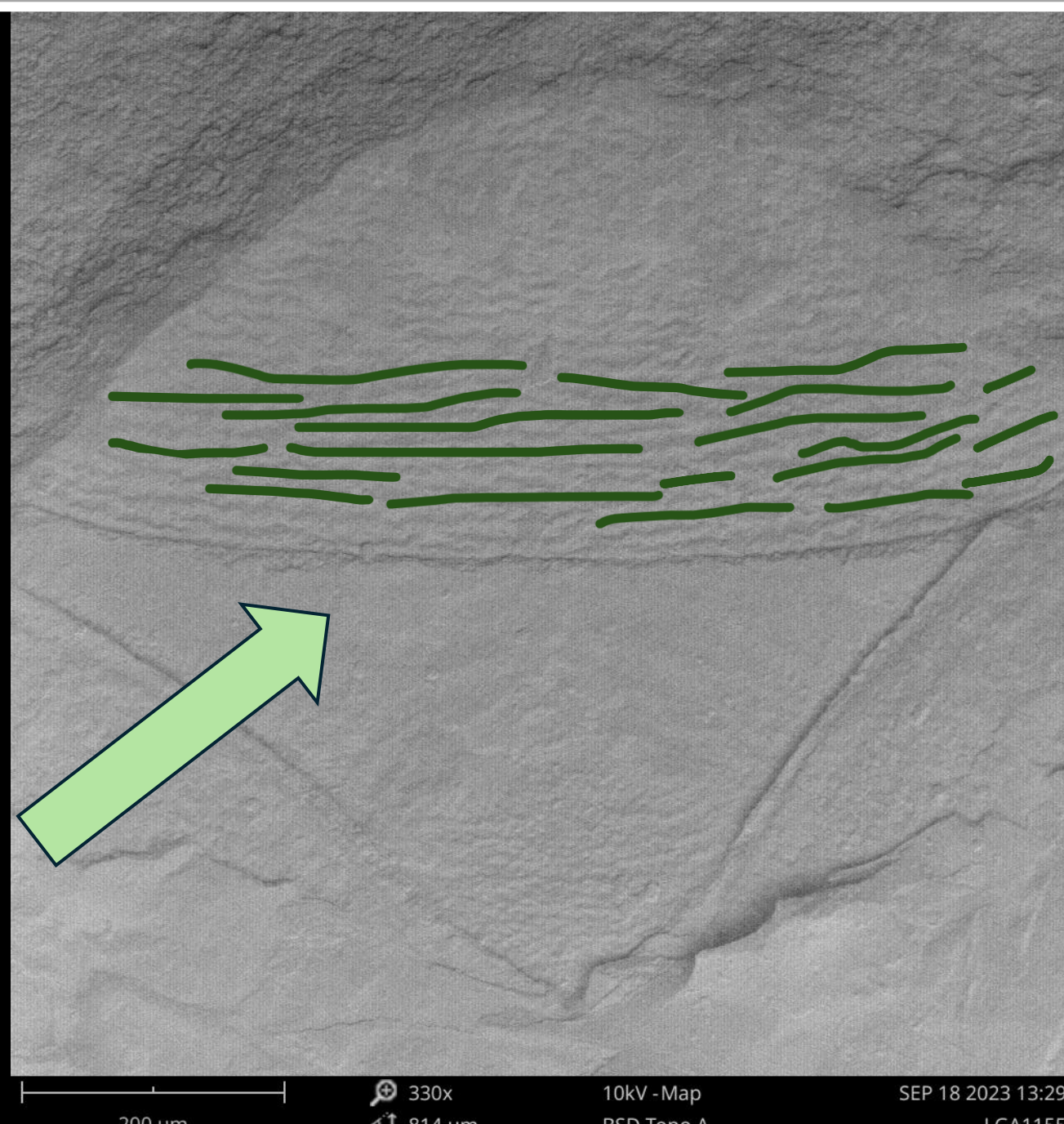
Macrosculpture and other features were documented using SEM [Scanning Electron Microscopy] and EDS [Energy Dispersive Spectroscopy] (Green 2001, Benton & Harper 2020).

Results:

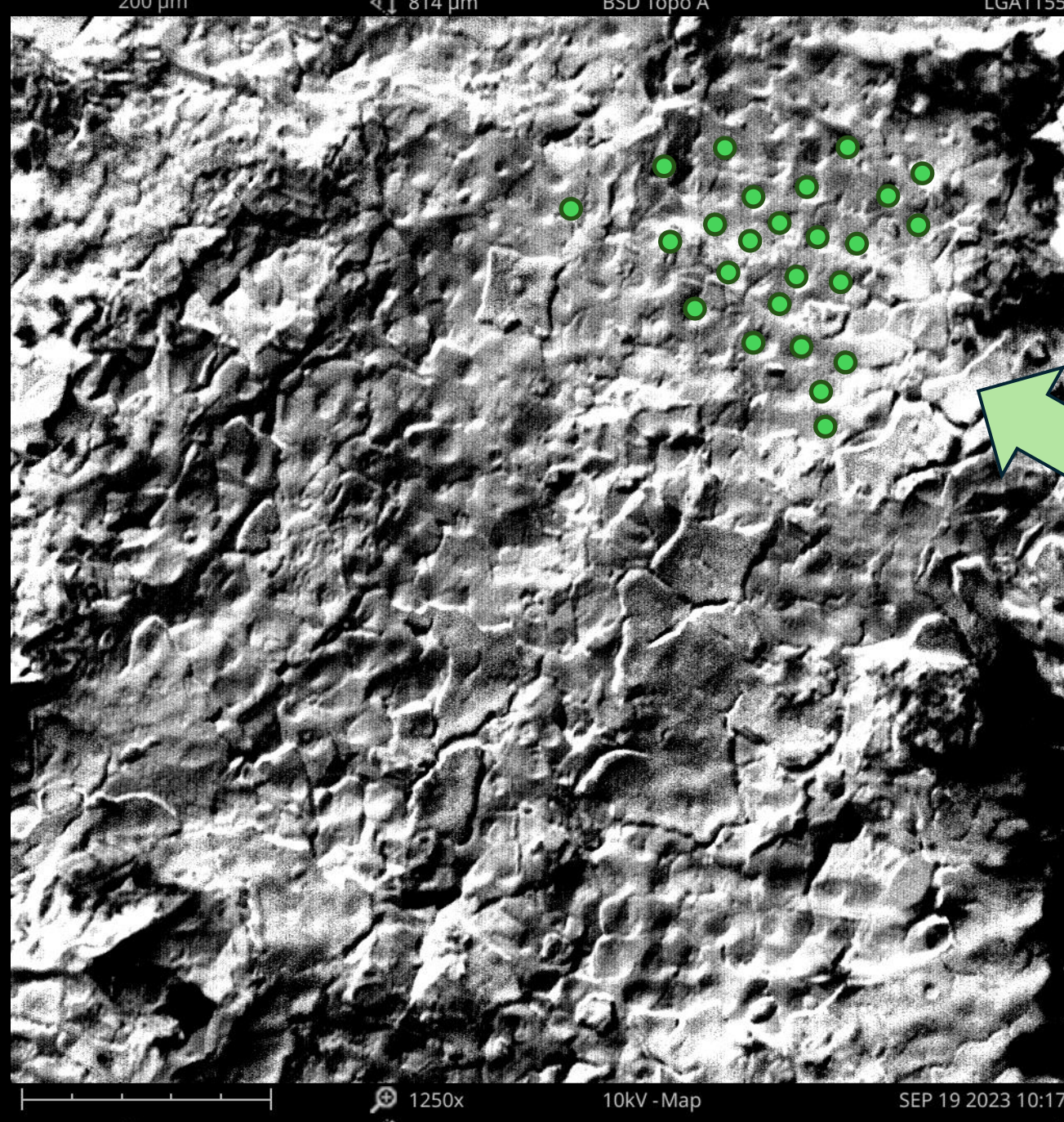
New macrofeatures have been discovered, revealing variability among species and genera in these characteristics, which can be valuable for taxonomy. These findings include:

- ❖ - different types of color remains of the cuticle
- ❖ - spinulation and other small details previously unknown in this taxon
- ❖ - new microfeatures of the pronotum and mesonotum
- ❖ - features of genital plates that are rarely preserved in previously known material
- ❖ - pustules, striae, strigae, and additional details

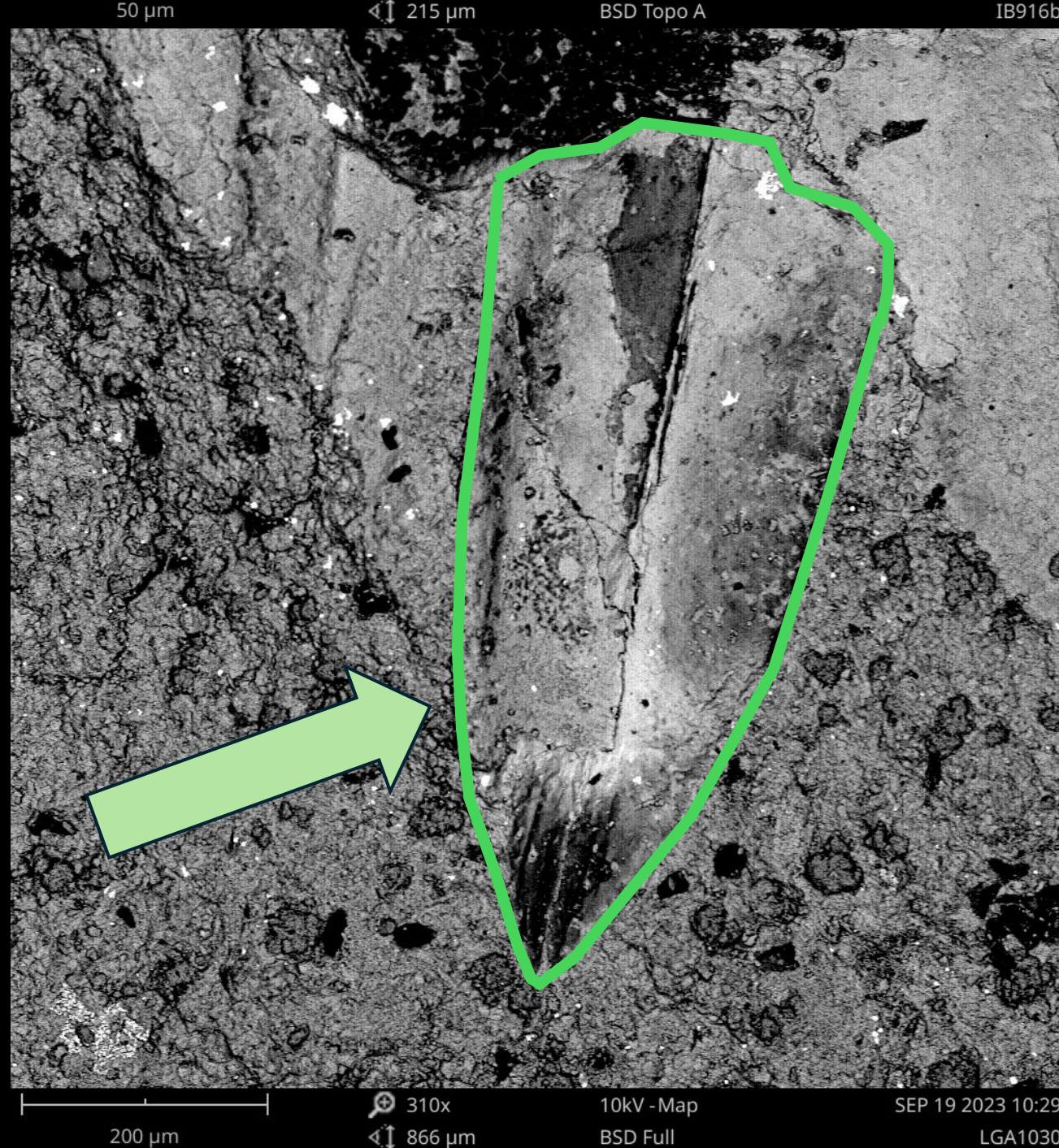
(1)



(2)



(3)



Pronotum is often well preserved in some of the specimens, however its colour and surface is not. Analysis of available specimens allow to distinct three different forms of pronotum. Smooth ones, lacking of microstructures and two forms of textured ones – strigulate (1) and pustulate (2)

The genital structures of Coleorrhyncha have been well studied, primarily in extant (living) representatives (Burckhardt 2009). In extinct species, only a limited number of Cretaceous specimens preserved in amber exhibit most of their morphological features (Jiang *et al.* 2019). In European Jurassic Coleorrhyncha, preserved genital capsules are rarely found; when they are, only shapes or parts of ovipositor gonapophyses may be visible.

References

